THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 1, 1899. CHICAGO, ILL. NUMBER 22

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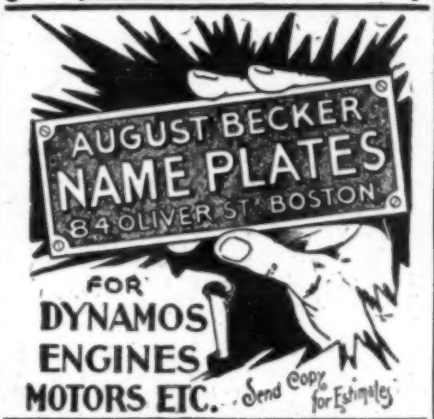

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On Page 25.

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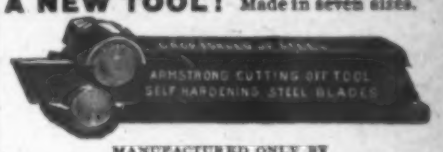

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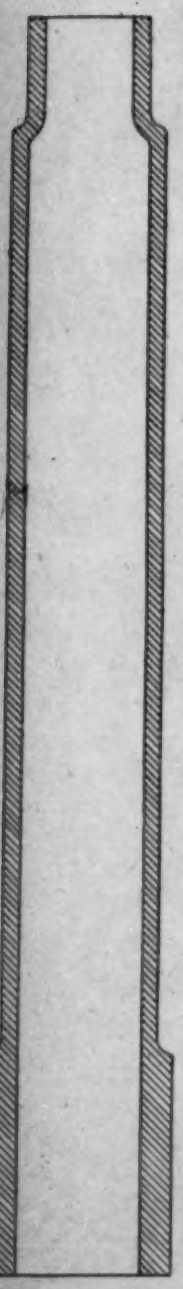

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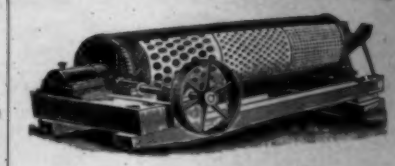

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 1, 1899. CHICAGO, ILL. NUMBER 22

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The iron market is still soaring and there is no sign that the end has been reached. May will go into the history of the remarkable advance of 1899 in the iron trade, as the month which more than any other fixed the market for the second half of the year on a high-level basis. More pig iron has been sold in the past month than in any since the strong upward movement began. The present level is dangerous and unfortunate, many in the trade freely admit. But it has been attained in spite of all cautions and protests, through the scramble of buyers for material, to make them sure of uninterrupted operation throughout the year. There is little use in attempts to stop such movements, as some producers have learned to their cost, and to-day the dominating purpose in the trade is to get out of the situation what it will yield. The future is being left to take care of itself. In the past week advances in prices have been quite general, and have resulted from continued buying at top prices. In non-Bessemer pig iron the movement has been particularly marked. In the Chicago district it was the largest in many weeks and included requirements for mills, foundries and malleable plants, the deliveries in a number of cases extending well into next year. The result is that Southern furnaces are quite fully sold into November and some of them into December of this year. For No. 2 foundry $12.50 Birmingham is now minimum and gray forge iron is $11.25 minimum, with sales made at $11.50. There is a disposition among some foundrymen to protest against the extent of the advance, but all such are finding that their neighbors are taking the iron and that it is almost entirely a question of getting a supply or deciding to shut down later in the year. It is inevitable, however, that hardship will result unless a very radical advance can be secured on the prices of castings. Between the increase in labor cost, added to the large increase in cost of iron, and on the other hand the very moderate advances in castings, many foundrymen are getting an unpleasant squeeze. The Bessemer furnacemen, at their meeting in Cleveland on the 25th, made a $17 price, valley furnace, but no iron is being offered at that figure. Sales are reported of outside iron at the Pittsburg equivalent of $17.35 valley furnace. The scarcity of steel grows yet more pronounced. Pittsburg mills are practically out of the market. Sales at $28 and $29 are reported. The demand in finished lines continues unabated, due in many cases to the unwillingness of buyers to contract largely, in the early stages of the advance, because of the rapidity of the upward movement, and the belief that by waiting they would get lower prices. Steel bars have gone to 2c Pittsburg, leading producers being sold for practically the balance of the year. Plates have advanced $3 to $5 a ton, being firm at 2.25c Pittsburg for tank, and higher prices being paid for June and July shipment. An advance in structural material is expected this week, probably not less than $2 a ton. The mills have been filling up steadily, and with important bridge and building contracts closed the advance to a level more in keeping with other lines is deemed safe without shutting off business. Wire and nails are expected to go higher, in view of higher raw materials. The wrought pipe consolidation is concluded on an $80,000,000 basis, as detailed elsewhere. The Carnegie Steel Co.'s new $250,000,000 capitalization plan is being developed quietly. About half this amount will be available for outside subscription if it is decided so to offer it. The understanding is that $10,000,000 of the stock will be set aside for the young men of the company, following the plan of the present organization. It has developed in the week that the Cleveland-Cliffs Iron Co. was a joint purchaser of Lake Superior Iron Co. stock with the Oliver Iron Mining Co., having a one-fourth interest. On this basis, 7-12 of the Lake Superior Iron Co. ore goes to the Carnegie Steel Co., one-fourth to the Cleveland-Cliffs Iron Co. and one-sixth to the Oliver interest, which in turn has sold its ore to the National Steel Co.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
705 PUBLICATION BUILDING, May 31.

The scarcity of material has become still more accentuated in the last week and fancy prices, even in comparison with those recently ruling, have been paid. At the same time, it is a fact that the inquiry is important only for the reason that there is so little material available. It would not take a large tonnage to meet all the demand now apparent. But very little conservatism is displayed, and estimates of shortages are being scattered broadcast, apparently in the effort to boost prices to a still more unnatural level. A shortage in pig iron may develop before the end of the year, but it is utterly impossible to predict any such thing with certainty at the present time. In the opinion of careful observers it would be very much better for the iron industry, as can be seen clearly enough later, if the efforts put forth to advance prices were exerted instead to hold them down, so that there might be some prospect of the continuance for a fair time of reasonably good prices. But only the extremely conservative in the iron business talk thus.

A considerable advance in chain prices was made on May 26. A meeting on Thursday will advance the price of structural material. The trade in steel and iron bars, small structural shapes, etc., has been surprised by the re-entry into the market within the past week or two of a number of manufacturers of agricultural machinery, who find they will require considerable more material of this class for machinery to be used this summer. Difficulty is being experienced in filling the requirements. W. P. Snyder has purchased the Douglas furnace at Sharpsville and formed the Shenango Furnace Co. to operate it. It will be blown in at once on Bessemer iron.

PIG IRON.—The Valley furnacemen have not agreed to sell any iron at the minimum price fixed last Wednesday in Cleveland—$17—and in fact are holding out for higher figures. A majority of them profess confidence that the market will soon stand $20. There is only a very limited tonnage available, and should there be any heavy inquiry this hope might be realized, but there is by no means a certainty that it will be, or at least that any such figure will represent the market for the balance of this year. We note sales at considerably over $17, including one at $18 delivered Pittsburg, and the market is now firm at $17.35 to $17.50 in the valley, with every prospect of considerably higher prices

should any important demand develop. In foundry irons the market has been quiet, there being little iron to be had, and only the most moderate demand. Prices are difficult to quote, but are about as last given. In mill iron there have been some sales and prices are firmer. We quote as follows:

Bessemer, valley furnace	$17 15 to $17 50
Bessemer, Pittsburg	18 00 to 18.15
No 1 Foundry	16.50 to 16 75
No. 2 Foundry	16.25 to 16.75
No. 3 Foundry	15.75 to 16.00
Gray Forge, valley furnace	14.75 to 15 00
Gray Forge, Pittsburg	15 00 to 15 25

STEEL.—The demand has been light. Steel is very scarce and difficulty is experienced in supplying even the limited demand. Transactions have not clearly established a market price, and the deliveries and the size of the order exercise a very important influence on the price. From $28.50 to $29, Pittsburg, represents the lowest figures that have been obtained, while sales have been made at $30, and even higher for small quantities. It is confidently predicted that the market will shortly pass the $30 mark; and if it does, it is hard to believe it will not pass it again shortly after.

FERRO MANGANESE.—The associated producers have again advanced ferro, which is now quoted at $85 for domestic 80 per cent in good sized lots, with higher prices for smaller quantities

RAILS AND TRACK MATERIALS.—The rail situation is quiet and unchanged, the mills being sold to their capacity. In track material we note a very good demand at former prices: Spikes. 1.90c to 2c; track bolts, 2.30c to 2.45c; splice bars, 1.75c to 1.90c; links and pins, 2c te 2.15c.

BARS.—The market is very firm for both steel and iron bars and sales are being made steadily at 1.90c to 2c for steel bars and 1.70c to 1.80c for iron bars. In the past week 2c has been fixed as minimum for steel by some producers. All mills are sold far ahead.

STRUCTURAL MATERIAL.—A large Government contract is being figured on and will likely be placed in this district. The question of delivery is the only one in dispute. The market is very strong. A meeting will be held Thursday morning in New York and will make an advance, probably of $2 a ton. For the present we quote former prices: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.05c; and angles, 1.50c to 1.55c; universal mill plate, 2c.

PLATES.—The plate market is still stronger, and for anything but very far-off deliveries 2¼c for tank plate is the lowest that can be done. We quote as follows: Tank, 2.25c; shell, 2.35c; flange, 2.45c; fire box, 3¼c to 3¾c.

PIPES AND TUBES.—As noted elsewhere, the consolidation of pipe and tube mills has been practically consummated. The market is very strong and prices remain as quoted last week: Merchant pipe, base discount, 60 per cent and additional discounts three 10's for less than carloads and three 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 45 for screw and socket joint and 40 for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 40 per cent; 1¾ to 2½-inch, 50 for iron and 55 for steel .2¾ to 6-inch, 55 for iron and 57½ for steel; extra 5 per centto dealers.

SHEETS.—The sheet consolidation will probably be completed by the end of June. The market is very strong, and only a very limited tonnage can be secured. There is a wide range of prices, and mills scarcely know what to name for what tonnage they are able to sell. We still quote No. 28 at 2.90c to 3c. In galvanized sheets the condition is unchanged. Material is scarce. The range of the market is about represented by 70 and 5 per cent off list.

SPELTER.—This market continues strong at 6¾c Pittsburg, for prompt.

OLD MATERIAL.—There is no change to note in this market. There is a fair run of business. We quote as follows: New melting stock, $13.50 to $13.75: old steel rails, long lengths, $12.50 to $13; cut, $13 to $13.50; old iron rails, $17 to $17.50; wrought iron scrap, $14 to $15; cast borings, $8, net, Pittsburg; busheling scrap, $11 to $11.50, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12, gross; charcoal scrap, $13, gross; wrought turnings, $8.50 to $9, net, Pittsburg.

COKE.—The coke market is if anything stronger than at last report. We note occasional sales of furnace coke at $2.15. We quote, for standard Connellsville, furnace coke, $2.15; crushed and foundry, $2.15 to dealers and $2.30 to consumers.

CHICAGO.

Office of The Iron Trade Review and Industrial World,
1522 MONADNOCK BLOCK, May 30.

Unusual activity in pig iron and in several leading lines of finished material has marked the week ending to-day. Prices are higher for the entire range of crude and rolled products. Stipulations as to deliveries are now almost entirely in sellers' hands; indeed, in the case of products so far sold ahead as plates, orders have been placed with deliveries as mills are able to make them. In foundry pig iron the advance has been partly in sympathy with Bessemer, and in part because it is becoming evident that the entire 1899 product in all kinds of iron will soon be sold. Considerable sales of both iron and steel bars have been made, implement firms being in the market. Plates are from $3 to $5 a ton higher, and leading mills are now booked for fully a month into the new year.

PIG IRON.—Prices have advanced 50 to 75 cents above last week's level. Southern iron is on a basis of $12.50 Birmingham for No. 2 as against $12 last week. The freight after June 30 will be $3.65 to Chicago, instead of $3.50. Both local and Southern furnaces have booked large amounts in the week. In the week just ending and the one preceding most of the manufacturers of malleable iron in the Northwest contracted as far ahead as makers were willing to sell, deliveries running in some cases as far ahead as July, 1900. There is more and more of a disposition to close at present prices for deliveries extending into next year, though some consumers have covered only in part for the months after Jan. 1, preferring to have developments in the next four or five months decide as to the remainder. Implement makers want to see how the farming community fares this year before committing themselves fully to the present high prices. We quote for cash as follows:

Lake Sup. Charcoal	$18 00	Southern Coke No. 3	$15 50 @ $15 75
Local Coke Fdy. No. 1	16 50 @ 17 00	Southern No. 1 Soft	16 50 @ 16 75
Local Coke Fdy. No. 2	16 00 @ 16 50	Southern No. 2 Soft	16 00 @ 16 25
Local Coke Fdy. No. 3	15 50 @ 16 00	Southern Silveries	16 50 @ 16 75
Local Scotch Fdy. No. 1	17 00 @ 17 50	Jackson Co. Silveries	19 00 @ 20 00
Local Scotch Fdy. No. 2	15 50 @ 16 00	Ohio Strong Softeners	19 00 @ 20 00
Local Scotch Fdy. No. 3	15 00 @ 15 50	Alabama Car Wheel	18 50 @ 19 00
Southern Coke No. 1	16 50 @ 16 75	Malleable Bessemer	17 50 @ 18 00
Southern Coke No. 2	16 00 @ 16 25	Coke Bessemer	18 00 @ 18 50

BARS.—Implement and wagon manufacturers have bought in considerable quantities. Car works are busy, but new car contracts are few and orders for material are not being placed. For mill shipments the quotations on common iron are 1.70c to 1.80c, but some re-sales, from old contracts, have been reported at 1.60c to 1.65c, though there is comparatively little of this iron to be had. Good sales have been made of soft steel bars at 1.85c to 1.90c Chicago. A number of implement contracts have been placed. Advances over these prices are expected, as Pittsburg mills have quoted 2c at mill and in some instances as high as 2 40c Chicago, half extras. Hoops and bands are in good demand and manufacturers quote 2.15c, base, Chicago.

STRUCTURAL MATERIAL.—New business is relatively quiet. Specifications are of good volume on old contracts. On universal plates an advance has

been made of $5 a ton, with no guaranty of delivery short of February. An advance in shapes is expected this week. We quote: Beams, 15 inches and under, 1.35c to 1.75c; 18 inches and over, 1.75c to 1.80c; angles under 3 inches and over 6 inches, 1.75c to 1.80c; 3 inches to 6 inches, 1.65c to 1.70c. Sheared plates, 2.35c to 2.40c; universal plates, 2.65c; tees, 1.70c to 1.75c; zees, 1.65c to 1.70c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—In spite of the well known condition of the mills, demand keeps up. The local mill is out of the market, while Pittsburg mills can make no deliveries short of early fall. Prices have been advanced and small lots of tank steel from stock are now selling at 2.75c to 3c. Mill shipments, Chicago delivery, are quoted as follows: Tank steel, 2.65c; shell, 2.75c; flange, 2.85c; marine, 2.95c; fire box, 3c to 5c, according to brand.

MERCHANT PIPE.—Manufacturers are now making no quotations for mill shipments while they quote two 10's off for such sizes as they can supply from stocks in their warehouses. The demand for boiler tubes is heavy, with prices unchanged.

SHEETS.—Inquiry for black sheets is active, but some mills do not quote, being well sold up for some time to come. There is a better demand for galvanized, and mill shipments are quoted at 70 and 10 to 70 off. We quote No. 27 black at 2.90c to 2.95c

MERCHANT STEEL.—Mills are crowded with work, and each inquiry for any considerable amount must be referred to the mill by agents. The demand is fair. We quote: Open-hearth spring, tire and machinery steel, 2.40c to 2.45c; smooth-finished machinery steel, 2.45c to 2.55c; smooth-finished tire steel, 2.25c to 2.35c; tool steel, 6c to 7.50c; special, 10c and upwards.

BILLETS AND RODS.—No quotations on billets are being made to consumers in this district. A small quantity of rods was sold from mill in the week. The nominal quotation is $37 to $38.

RAILS AND TRACK SUPPLIES.—The local mill has refused orders for standard sections of steel rails because of inability to make desired deliveries. We quote $26 to $28. On light rails deliveries cannot be made short of three months. We quote at $30 to $37, according to weight. Splice bars are 1.50c to 1.55c; spikes, 2.25c to 2.35c; track bolts, 2.85c to 3c.

OLD MATERIAL.—Sales have been made of nearly all kinds of scrap. Offerings have been made to the new rolling mill consolidation in the past week, but it is not buying heavily. Thus far old material has not shared in the advance in pig iron. We quote dealers' price:

Old iron rails, gross,	$18 00@$19 00	Axles, net	$18 50@$19 50
Old steel rails, long, gr.	13 00@ 13 50	Cast borings, net	6 00@ 6 50
Old steel rails, mixed	12 00@ 12 50	Wrought turnings, net	8 50@ 9 00
Old wheels, gross	15 50@ 16 50	Axle turnings, net	9 00@ 10 50
Railroad forge, net	15 50@ 16 50	Mixed steel, gross	@ 8 50
Dealer's forge, net	12 00@ 12 50	Stove plates, net	8 00@ 8 50
No. 1 mill, net	9 50@ 10 50	Heavy melting steel, gr.	11 00@12 00
Heavy cast, net	13 00@ 13 25	Old iron splice b., net.	18 50@19 00
Malleable cast, net	8 50@ 9 50		

WIRE AND WIRE NAILS.—In view of the continued upward movement of steel a further advance in wire and nails is looked for. There is a growing demand for wire nails as the season advances. Manufacturers continue to quote a Pittsburg mill price equivalent to $2.35 Chicago for wire nails in carload lots. With wire rods at $37.50 a higher price for nails is believed to be justified. The demand for both plain and barb wire is very heavy. In single carload lots plain annealed wire is sold at $2.20, painted barb wire at $2.45, and galvanized barb wire at $2.95.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.* 27 VINCENT ST., May 31.

The ore movement in May has been of larger proportions than might have been expected with so late a start, and with the interruption caused by the Buffalo strike and the resulting blockade. There is no occasion yet for any predictions of inadequate season shipments. In the past week rates on ore have held up, owing to the lively grain movement, to avoid June elevator charges, and 75 cents from the head of the lake has been paid, 65 cents from Marquette and 60 cents from Escanaba. There are some few lots of ore available for buyers who are trying to start old furnaces and these bring from $1 to $1.25 above the opening prices The scale of operations at Lake Superior mines is fully up to calculations, but more men could be used at a number of properties. One interest expects to take a number of miners from Pennsylvania to the Lake Superior country in the next week. Losses of men to the copper country are still to be reckoned with. The stimulus of high priced pig iron is very evident in the way the ground is being beaten over for old ore properties that might be wrought under such favorable conditions as prevail. The Marquette and Menominee ranges are having special attention in this regard, and further announcements may soon be made of transfers or resumptions. On the Mesabi range the leading properties are being pushed for large outputs. The Oliver Iron Mining Co. will take this season's quota from the Mountain Iron, and the Oliver and Lone Jack will go unworked for the year.

PIG IRON.—The meeting of Bessemer furnace operators in Cleveland on May 25th put the price of Bessemer iron at $17 in the valley, but there is no disposition to sell at that price. Some Bessemer iron in other hands has brought more than $17. Considerably more than half the purchases made by steel works in the past two months for delivery in the second half were at $14 and $15. On the 50,000 tons the furnaces yet have to sell it is the evident purpose to realize whatever profit the needs of steel plants will yield, furnacemen arguing that as long as sales of steel are made at $28, Bessemer iron will bring more than $17, in view of the short supply and the inquiries yet unsatisfied. Foundry iron, in line with the movement in Bessemer, is higher, and buyers are coming into the market week by week and paying the current price. Southern iron advanced 50 cents last week, or to $12.50 at furnace for No. 2 foundry. Northern No. 2 foundry is quoted $16 valley, by most furnaces and sales with deliveries extending into 1900 are made on that basis. Small lot sales have been made at $16.25 and $16.50. Foundries are urging forward their iron, since work is coming in upon them much beyond expectations. In mill iron the market is firmer and it is believed the mills must yet make considerable purchases for the second half. Southern gray forge is quoted at $11.25 and $11.50, Birmingham. We quote Cleveland prices:

Bessemer	$17 75@18 00	Valley Scotch No. 1	$16 90@17 40
No. 1 Strong Foundry	16 90@17 40	Valley Scotch No. 2	16 65@16 95
No. 2 Strong Foundry	16 65@16 90	Gray Forge, valley	15 00@15 25
No. 3 Foundry	16 15@16 40	Lake Superior Charcoal	18 00@19 00

FINISHED MATERIAL.—The heavy demand for steel bars keeps up and has led to another advance in prices. Some of the Pittsburg mills are sold for practically the balance of the year, and recently agricultural implement buyers have placed additional orders. The minimum quotation with mills able to make further sales for 1899 is 2c, Pittsburg. We quote bar iron at 1.65c, valley mill, in carload lots. Cleveland deliveries are 1.70c in carload lots and Cleveland sales out of stock are at 1.75c to 1.80c. On structural shapes prices are unchanged, and bridge and structural fitting works are specifying liberally on contracts. Mills are filled up into August. We quote beams and channels at 1.50c, Pittsburg, and angles at 1.50c to 1.60c. Plates, in spite of the increased capacity to be ready in the Pittsburg district about the middle of the year are firm at 2.25c to 2.35c, Cleveland, for tank. A number of vessels are likely to be placed with lake yards in the near future, but plates are largely covered by options taken earlier in the year. The sheet demand upon jobbers' stocks is active, particularly so in galvanized. We quote No. 27 black sheets at 2.90c to 2.95c, Pittsburg mill. Out of stock in Cleveland the price is 3.20c. Open-hearth sheets are exceedingly scarce, as mills find it almost impossible to get open-hearth sheet bars. In merchant pipe dealers' stocks are more and more a dependence, in view of the heavily sold condition of the mills. The wire and nail mills in Cleveland are being pressed for shipments and new demand is large, particularly in barb wire. We quote the market, with an early advance probable, on the following basis, Pittsburg mill: Wire nails to jobbers in carload lots, $2.10; smooth

wire, $1.95, carload lots; painted barb wire, $2.20, carload lots; galvanized, $2.70, carload lots.

OLD MATERIAL.—There has been considerable activity in the past week, the Republic Iron & Steel Co. having bought 10,000 to 15,000 tons for immediate shipment, a considerable portion of which goes to valley and local mills. Foundry scrap is firmer, in view of the advance in iron, and steel melting stock has sympathized with Bessemer iron. We quote No. 1 railroad wrought scrap at $16, valley mill; busheling scrap, $12.50; old iron rails, $19.50 to $20; old steel rails, $14.50 to $15; machinery cast scrap, $12.50; cast borings, $8; grate bars, $8; stove plate, $8.50; old car wheels, $16.

CINCINNATI.

May 29.

May has proved the banner month of all the months since the advance began. Sales have been heavy and continuous. In fact so large has been the aggregate of the recent contracts into which the Southern furnaces have entered that the majority of them are now practically out of the market until November, and in one or two instances until December. The demand during the past week has been for foundry irons and more has been wanted than could be supplied. There is now beginning to be a vigorous protest on the part of many foundrymen against the prices that are being asked. Some of them state that at present prices for pig iron unless there is a much more radical advance in the price of castings than seems now obtainable, they will be forced to do business at a loss. They apparently feel that the iron masters are in danger of killing the goose that lays the golden eggs. But selling agents report that these protests are few and feeble compared with the great chorus of those who must have iron at any figure. The mails are still burdened with the complaints of those who are not getting iron as fast as it is wanted. We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $15.75; No. 2, $15.25; No. 3, $14.75; No. 4 and gray forge, $14.25; mottled, $14.25; No. 1 soft, $15.75; No. 2 soft, $15.25; Lake Superior coke, No. 1, $16.75 to $17.25; No. 2, $16.50 to $17; Hanging Rock charcoal No. 1, $20 to $21; Jackson Co. silvery No. 1, $19 to $19.50; Standard Georgia car wheel, $16.50 to $17.50; Lake Superior charcoal, $20.50 to $21.

St. Louis and Milwaukee Foundrymen Organize.

At a recent meeting of the foundrymen of St. Louis, an organization was formed with the following officers: George Q. Thornton, president; William T. Koken, vice-president; and John M. Harrison, secretary and treasurer. The following foundries were represented and signed the constitution: Ætna Iron Works, Carondelet Foundry Co., Christopher & Simpson Amalgamated Iron & Foundry Co., George J. Fritz Foundry & Machine Co., Gerst Bros.' Mfg. Co, Koken Iron Works, John C. Kupferle Magnetite Foundry Co., Medart Patent Pulley Co., Pleuger & Henger Mfg. Co., St. Louis Car Wheel Co., St. Louis Iron & Machine Works, Shickle, Harrison & Howard Iron Co., South St. Louis Foundry Co, Union Iron & Foundry Co., and Whitman Agricultural Co.

At a recent meeting of foundrymen in Milwaukee the Milwaukee Foundrymen's Association was organized for purposes of mutual benefit. The organization was completed with the election of C. A. Sercomb, Schwab & Sercomb, president; Thomas Sherriffs, Sherriffs Mfg. Co., secretary; T. J. Nacy, Filer & Stowell Co., vice-president, and E. K. Rundle, Rundle & Spence Mfg. Co., treasurer. The association has about 25 members, including foundrymen from Milwaukee, Racine and Port Washington, Wis. The question of prices is one that will have some attention from the association, the expectation being that associated effort will result in a better understanding among manufacturers in the various lines.

THE Inland Steel Co., of Chicago, whose works at Chicago Heights turn out bars, angles, channels, tees, plow beams, and special shapes for agricultural implements, has not been absorbed by the Republic Iron & Steel Co. The statement in various papers doubtless grew out of the similarity of the names of this company and the Inland Iron & Forge Co. The Inland Steel Co. is not a part of any consolidation.

LAKE SUPERIOR IRON MINES.

In connection with the recent purchases of stock of the Champion Iron Co., it is reported that the Oliver Iron Mining Co. has been negotiating for the purchase of the Champion mine.

F. B. Baird, of the Union Iron Works, Buffalo, whose furnace is expected to go in blast about July 1, has taken an option on the East New York mine at Ishpeming, Mich., the fee of which is owned by M. A. Bigelow, of New York. Exploratory work will begin at once after the water has been removed. The East New York was last active in 1892 and in that year and the five preceding shipped 166,243 tons.

A new hoisting plant is being installed at the Curdy mine at Quinnesec, Mich. It was manufactured by the Webster, Camp & Lane Machine Co., Akron, O., and consists of 8x8 feet drums and 24x48 inch engines. It will hoist at the rate of 600 feet a minute and is calculated for a depth of shaft of 1,500 feet.

John M Thomas, formerly of Niles, O., has transferred to J. Alva Jenkins, of Mt. Vernon, N. Y., the N. E. ¼ of the S. E. ¼ of section 4. 58-18 on the Mesabi range, and his interest in a lease to Geo. A St. Clair, now held by the Aetna Iron Co. This property is in reality transferred to the Lake Superior Consolidated Iron Mines, who agree to furnish Mr. Thomas with all the ores necessary for his furnace at Duluth. This contract extends over a long term of years.

The Colonial Iron Co., which has filed a lease for half the Hale mine, Mesabi range, also owns the lease to the Kanawha property, which adjoins the Hale. The intention is to strip the Kanawha. The company will mine about 75,000 tons of ore this year. The Colonial company is composed of Joseph Sellwood, Harry Roberts, William White, of McKinley, and J. H. Bartow, of Cleveland.

The Davis Iron Mining Co. has been organized at Ironwood, Mich., to operate the Davis mine.

The Colby Iron Mining Co. expects to develop the Puritan, Federal and Ironton mines, all at Bessemer, Mich. Some work has been done on the Federal.

The Stevens property on the Mesabi range, located near the Adams and sometimes called the Adamson, has been acquired by the Oliver Iron Mining Co. The royalty is 15 cents. A large body of ore is said to have been proved up.

The reported acquisition of the Breen mine on the Menominee range, by the Minnesota Iron Co., is based on the taking of an option for one year on the Breen and the Emmet adjoining. Exploratory work will determine whether a lease will be taken.

The vessels of the Lake Superior Iron Co. will hereafter be operated by Edwin S. Mills, agent, from the offices of the Oliver Iron Mining Co, Perry-Payne Bldg., Cleveland.

T. F. Cole is now general superintendent, in charge of operations at all the Oliver Iron Mining Co.'s properties.

A charter has been granted to the Colonial Iron Co., of Riddlesburg, Pa. The capital is $150 000 and the incorporators are Henry H. Adams, of New York, Charles H. Scott, of Pittsburg, James P. Boor, L. B. Shaw, and William E. Souders, of Riddlesburg. The company has purchased iron ore and coal lands, together with the two Kemble furnaces at Riddlesburg, Pa. These furnaces have for some time been turning out "Norway" foundry iron. The property was sold at trustees' sale on April 15. Mr. Adams, who is the controlling stockholder in the Colonial Iron Co., was the purchaser. The Kemble furnaces have their own coke supply.

In May, the Kentucky Fire Brick Works, of Portsmouth, O., had orders on their books for six blast furnace linings, all going to different destinations, besides about two millions of hot blast stove brick and current orders. This works ran full time through the dull period of 1895, 1896 and 1897. In 1898 the trade was such that an addition of about 50 per cent was added to the capacity. The enlarged plant is now running day and night. The works are located at Firebrick, Lewis Co., Ky. Specialties are made of blast furnace, stove, cupola and rolling mill brick, and the brands are "Kentucky Steel," "Franklin Crown," and "Sligo."

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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G. H GARDNER, President. A. I. FINDLEY, Editor.

CHICAGO:
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R. M. GARDNER, Associate Editor and Western Manager.

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JUNE 1, 1899.

TECHNICAL MEN AND SHOP MEN.

Only those who have been identified with the foundry association movement from the beginning can appreciate what such a gathering represents, as that at Pittsburg two weeks ago. It is but a little more than seven years since the Foundrymen's Association at Philadelphia, the first in the country, was started. And the foundrymen of the Middle and Western States, at whose request *The Iron Trade Review* made the call for a preliminary meeting at Chicago during the World's Fair in 1893, will readily recall the amount of patient cultivation required to bring the Philadelphia idea into vigorous life, after it was transplanted in the West. But at length the Western Foundrymen's Association became so successful that the New England foundrymen followed the example. Then Pittsburg foundrymen caught the inspiration as the fruit of the National gathering at Philadelphia in 1896; and to-day the only wonder among progressive foundrymen is that they went so long without realizing the benefits flowing from associating themselves together for the study of shop practice on its metallurgical and mechanical sides.

Papers on blast furnace and steel works practice were no new thing. These the American Institute of Mining Engineers had been bringing out for years, and the result is a splendid body of literature on the metallurgy of iron and steel, in these two departments. Steam and the applications of power in machine shops and engineering works, not omitting the foundry, were represented in the magnificent work of the American Society of Mechanical Engineers. It may have seemed presumption in the foundrymen, whose shops were regarded as only ill-kept appendages to well-kept machine shops, to organize for the study of foundry practice, and that alone. But there were those who were prophets enough to see that the foundry was not always to be the haphazard institution it so long had been regarded. As one indication that they were not wrong, we may cite the examples of advanced practice represented in the two illustrated evening papers read before the Pittsburg meeting. Whatever individual initiative has done, under the spur of the depression of 1893 and following years—and much of the improvement of recent years was due to hard necessity—there is yet a large factor of generally diffused betterment in foundry method and equipment which is traceable to the monthly and annual association meetings, with their stated papers and the discussions these have brought about.

There have been two classes of contributors to foundry association literature—those who as engineers, metallurgists and chemists have had to do with foundry operations because of a preliminary training in technical institutions and a later experience in the practice of works, in which they have had opportunity to apply what the schools gave them; and on the other hand those whose acquaintance with foundry practice has come almost entirely from experience as workmen on the molding floor, at the cupola, and at length in the supervision of operations, through promotion from the ranks. Each of these classes has made notable contributions to the proceedings of the associations. That each has not always fully appreciated the other has been in evidence now and then. Those who sat in the Franklin Institute at Philadelphia and heard the discussion at the second day's meeting of the National convention of 1896 will well remember the onslaught of the foundry floor upon the so-called theory of the technical corps. The discussion ranged over a vast expanse of physics and chemistry, bad iron and bad castings, test bars large and small and round and square. Graduates of the molding floor seemed almost disposed to maintain that cast iron operations were presided over by a fickle genius who took delight in thwarting the cleverest plans for the making of sound castings; while the technical gentlemen present, with well assumed patience endeavored to indicate how many uncertainties would disappear before an intelligent application of science to the making of mixtures, the melting of the metal and its later manipulation. Probably that discussion, with its multiplied crudities, was one of the most valuable of all, in that it showed the lines on which the campaign of education must proceed, and the deep-rooted difficulties it must encounter.

It must be said that one result of the mingling of foundry floor men and technical men in the various associations has been to beget a more wholesome respect in each for the other. Community of interest has been established. But there is much to be done to bring the two elements to occupy common ground. On the technical side not a little of the progress that has been made in the study of cast iron in the United States has been due to the willingness of the so-called rule-of-thumb element in the foundry associations to adopt advanced methods so far as they are demonstrated to have a practical outcome. It is admitted on the other side of the water that more attention has been paid to cast

iron in the United States than in Europe. Yet investigators here know that only a good beginning has been made. And this explains the slowness of many practical foundrymen to take an advance step. Some of them make the point that the technical men should be better agreed before they ask the foundry world to abandon what it so long has leaned upon. They have been told that silicon is the key to the regulation of foundry mixtures. Yet in one of the latest papers on cast iron, that of Bertrand S. Summers before the Iron and Steel Institute, the author emphasizes the position taken in his Buffalo paper before the American Institute of Mining Engineers, that carbon, rather than silicon, is to be the controlling element in planning foundry mixtures, as so much depends upon the state in which the carbon exists. Silicon, he grants, has an effect on the state of the carbon, by retaining it in the graphitic form, but its action is dependent upon the temperature. The preponderance of graphitic temper carbon, he holds, explains the strength of certain so-called semi-steels and other forms of cast iron.

We do not justify the criticism of the old-school foundrymen. It is no more reasonable than to ask rival schools of medicine to agree before either essays to treat a patient. We refer to it simply as a sentiment that exists; and its existence is not altogether an evil, since it will modify and give practical direction to the work on technical lines.

It should not be understood, in this connection, that there is a sharply defined line between the two elements in the new foundry movement. There are members of the American Foundrymen's Association who exemplify the happy mingling of the thoroughly scientific and the thoroughly practical—to whom foundry metallurgy and foundry mechanics are both science and art. These men have contributed vastly to the advances that have been made; and they are the balance wheels of the movement. Their services will be further valuable if they will recognize the great interest the average foundry proprietor, superintendent and foreman take in important questions apart from the constituency of pig iron and the effect of the various metals and metalloids upon the character of cast iron. No paper read before the American Foundrymen's Association has attracted more attention and discussion from working foundrymen than that of James A. Beckett on "Cupola Practice," at the Detroit convention two years ago. And that heat treatment and other factors that have been made prominent in the experience of the foundry-trained expert are of great importance is emphasized again in the admirable remarks of Mr. P. Kreuzpointner on Mr. West's paper at the Pittsburg convention.

Much will depend, if the future of the foundry association movement is to show results equal to those attained thus far, upon the mutual tolerance of technical men and shop-trained men, and upon following such lines of discussion and of experiment as shall not only interest and hold those who have co-operated heretofore, but make large additions to their ranks.

EXCESSIVE WAGE DEMANDS.

No exception can be taken to the stand of the Amalgamated Association at its Detroit convention for advances in wages in every department of operations represented in its membership. But the association has gone too far. It has used the present prosperity in the iron trade to justify demands that can only tempt more manufacturers to take direct issue with an organization that while claiming to be dominated by conservative elements is, in this instance, at least, plainly in the hands of extremists. The advance of the base, in the puddling and finishing scale, certainly can have no justification except the desire of the workmen to make sure that wages shall not go down in proportion to prices, when the descent to the depths again comes upon the trade. On the present price of bar iron the puddling rate is $5.75, an advance at once of $1.75, to which is to be added the advance per ton on finishing scales, giving from $2.50 to $3 advance in the labor cost of a ton of bar iron. This added to $6 a ton advance in forge iron, means that with bar iron at 1.65c, valley mill, only 15c to 20c per 100 pounds, out of the 1.65c advance above the basis of 1898, goes to the manufacturer. This, on a market level that has not been paralleled in eight years.

In the tin plate scale the height of the over-reaching demands of the radical element in the association was reached. In the first place the basis is advanced 20 per cent. Then the ratio fixed between a ton of sheet bars and a 100-pound box of tin plates is changed to 7 and 1, corresponding practically to the present relation between sheet bars at $27 net ton and tin plates at $3.87½ a box. Further, a change from 2 to 5 per cent was made in the advance which is to come from every $2 deviation in favor of the manufacturer, from the ratio as established. Thus on a scale base 120 per cent of that now prevailing, if there should come a $2 decline in sheet bars, with tin plate prices remaining as at present, there would be a 5 per cent advance upon a 120 per cent base, making a total wage advance of 26 per cent. Taking an extreme case—sheet bars at $15 net ton (as they have been) and tin plate at $3.87½ as at present—the proposed scale would give six wage advances of 5 per cent each, which calculated on a 120 base would be 6 per cent each or 36 per cent in all. This added to the 20 per cent base advance would be 56 per cent advance in all.

It is not surprising that the conferences between manufacturers and workmen at Detroit ended in adjournment without agreement. Manufacturers certainly need time to comprehend a program so magnificent in its designs upon the benefits of improved conditions. The tin plate manufacturers, in particular, who gave an advance two years ago, when there was nothing in the general conditions to suggest wage advances, will have reason to conclude that the appetite for unreasonable demands grows by what it feeds upon.

In general the scales made at Detroit seem to have been formed without any regard to the fact that in some important products mills governed by the scale must compete with others which have long been emancipated from Amalgamated Association control. Some of these scales could scarcely have been better constructed, had the main aim been to handicap producers who have maintained friendly relations with the association. It is to be remembered that low prices will follow the high level, and it is a misnomer to call a "sliding" scale that which slides up all the way, and only slides down as far as an artificial minimum will let it.

Iron and Steel Production in 1898.

The annual statistical report of the American Iron and Steel Association has just been sent to the members of the association by General Manager Swank. Some of the information, particularly concerning the course of the iron trade, in respect to prices and volume, has been brought down to May of the present year. We have given from time to time the statistics of production in leading lines, as Mr. Swank has brought them out in the *Bulletin*. The table below in which gross tons are given for all items except coke and nails, summarizes the information. It represents production, with the exception of Lake Superior ore and Connellsville coke, in which the figures stand for shipments:

	1897.	1898.
Iron ore from Lake Superior,	12,463,793	14,029,682
Connellsville coke, in net tons,	6,915,052	8,460,112
Pig iron, including spiegel and ferro,	9,652,680	11,773,934
Spiegeleisen and ferro-manganese,	173,695	213,769
Bessemer steel ingots and castings,	5,475,315	6,609,017
Open-hearth steel ingots and castings,	1,608,671	2,230,292
All kinds of steel,	7,156,957	8,932,857
Structural shapes not including plates,	583,790	702,197
Plates and sheets, except nail plate,	1,207,286	1,448,301
All rolled iron and steel, except rails,	5,353,836	6,532,129
Bessemer steel rails,	1,644,520	1,976,702
All kinds of rails,	1,647,892	1,981,241
Street rails, included above,	122,244	143,815
Iron and steel wire rods,	970,736	1,071,683
All rolled iron and steel, includ'g rails,	7,001,728	8,513,370
Iron and steel cut nails, in kegs,	2,106,799	1,572,221
Iron and steel wire nails, in kegs,	8,997,245	7,418,475

Pig Iron Production and Consumption.

A resume of the figures for pig iron production for a number of years is given, showing 6,657,388 tons in 1894; 9,446,308 tons in 1895; 8,623,127 tons in 1896; 9,652,680 tons in 1897 and 11,773,934 tons in 1898. The consumption of pig iron in the past five years is shown approximately in the following table, in gross tons, the comparatively small quantity of foreign pig iron held in bonded warehouses not being considered. Warrant stocks are included:

Pig Iron.—Gross Tons.	1895.	1896.	1897.	1898.
Domestic production	9,446,308	8,623,127	9,652,680	11,773,934
Imported	53,232	56,272	19,212	25,137
Stocks on hand January 1	661,328	506,132	847,686	874,978
Total supply	10,160,868	9,185,531	10,519,578	12,674,049
Deduct stocks December 31	506,132	847,686	874,978	415,333
Also exports	26,164	62,071	262,686	253,057
Approximate consumption	9,628,572	8,275,774	9,381,914	12,005,659

It appears from this table that our consumption of pig iron in 1898 averaged a little over 1,000,000 tons per month.

Steel Production for Five Years.

The production of steel in 1898 and the four years preceding is shown in the table below. Of the 2,230,292 tons of open-hearth steel produced in 1898, 120,587 tons was castings. O these 28,460 tons was basic and 92,127 tons acid open-hearth castings. Bessemer steel direct castings in 1898 amounted to 3,539 tons. No new standard Bessemer works were erected in 1898. A plant to manufacture steel by the Tropenas process, a modification of the standard Bessemer process, was built at Derby, Conn., by the Driggs-Seabury Gun & Ammunition Co. Early this year the Milwaukee Steel Casting Co. erected a 2-gross-ton Tropenas converter. The Union Iron Works, of San Francisco, are building a 2-gross-ton Tropenas converter; and the Longview-Kelly Co., of Longview, Tex., is installing a 1-gross-ton Tropenas converter.

STEEL INGOTS.

	1894. Gross tons.	1895. Gross tons.	1896. Gross tons.	1897. Gross tons.	1898. Gross tons.
Bessemer steel,	3,571,313	4,909,128	3,919,906	5,475,315	6,609,017
Open-hearth steel	784,936	1,137,182	1,298,700	1,608,671	2,230,292
Crucible steel	51,702	67,666	60,689	69,959	89,747
Miscellaneous	4,081	858	2,394	3,012	3,801
Total	4,412,032	6,114,834	5,281,689	7,156,957	8,932,857

Structural Shapes.

The statistics of iron and steel structural shapes embrace the production of beams, beam girders, zee bars, tees, channels, angles, and other structural forms, but they do not include plate girders made from plates. Plates are provided for under other classifications, and under the general statistics of plates are included all plates cut to specifications. Nearly all the structural shapes and plates used for structural purposes are made of steel. The total production in 1897 and 1898 by states was as follows:

States.—Gross tons.	1897.	1898.
New England, New York and New Jersey	20,785	27,919
Pennsylvania	538,055	641,726
Kentucky and Alabama	2,384	3,588
Ohio	13,629	21,233
Colorado and California	8,937	7,731
Total	583,790	702,197

The increased production of structural shapes in 1898 as compared with 1897 was 118,407 gross tons, or over 20 per cent. Pennsylvania made over 91 per cent of the total production of 1898, New Jersey almost 4 per cent and Ohio over 3 per cent. No other state made over 1.5 per cent. The total production of structural shapes in 1897 was 583,790 tons, in 1896 it was 495,571 tons and in 1895 it was 517,920 tons.

Production of Plates and Sheets.

The production of plate and sheet iron and steel in the United States in 1898, excluding nail plate, amounted to 1,448,301 gross tons, against 1,207,286 tons in 1897, 965,776 tons in 1896, 991,459 tons in 1895, 682,900 tons in 1894, 674,345 tons in 1893, and 751,460 tons in 1892. Skelp iron and steel are not included in our tables with plates and sheets but with other rolled products. The following table gives the production of iron and steel plates and sheets, by States, not including nail plate, in 1898, in gross tons. "In 1894, at the request of the manufacturers, we separated plates and sheets by gauges, observing the following classification: Plates, up to No. 8, inclusive; firebed, Nos. 9 to 19 inclusive; sheets, Nos. 20 to 25 inclusive; and No. 26 and thinner gauges. This classification was continued until 1898, in which year the classification given in the following table was adopted." The production by gauges in 1898 was as follows, as nearly as can be determined from the returns:

States.—Gross tons.	Up to No. 8 inclusive.	No. 9 to No. 17 inclusive.	No. 18 and thinner.	Total. Gross tons.
New England		243		243
New York and New Jersey	2,110		1,000	3,110
Pennsylvania	522,851	79,841	315,718	918,410
Delaware and Maryland	1,600	552	19,111	21,263
West Virginia	67	2,650	30,247	32,964
Kentucky and Alabama	8,350	5,713	14,650	28,713
Ohio	33,397	21,927	201,129	256,433
Indiana, Illinois and Missouri	70,486	6,599	110,080	187,165
Total	638,861	117,505	691,935	1,488,301

The production of "black plates for tinning" alone in 1898 is reported to have amounted to 345,254 gross tons, against 271,886 tons in 1897, an increase of 73,368 tons, or almost 27 per cent. Of the production in 1898, Pennsylvania made 149,562 tons; Indiana, 80,028 tons; Ohio, 77,788 tons, and Maryland, West Virginia, Kentucky, Illinois and Missouri, 37,876 tons. The production of "black plates for tinning" in 1896 was 185,387 tons, against 129,615 tons in 1895 and 52,359 tons in 1894.

Production of Wire and Cut Nails.

The production of iron and steel wire nails in the United States in 1898 amounted to 7,418,475 kegs of 100 pounds each, compared with 8,997,245 kegs in 1897, a decrease of 1,578,770 kegs, or over 17 per cent. In 1896 the production amounted to 4 719,860 kegs, in 1895 to 5,841,403 kegs, in 1894 to 5,681,801 kegs, and in 1893 to 5,095,945 kegs. The wire nails produced in 1898 were manufactured by 59 works, five less than were in operation in 1897. It may be interesting to note in this connection that while the production of wire nails fell off in 1898 the output of wire rods increased from 970,736 gross tons in 1897 to 1,071,683 gross tons in 1898.

The statistics of iron and steel cut nails and cut spikes do not include railroad and other spikes made from bar iron, wire nails of any size, or machine-made horse shoe nails. Cut spikes are included with cut nails. The total production of cut nails in 1898 was 1,572,221 kegs of 100 pounds each, against 2,106,799 kegs in 1897, a decrease of 534,578 kegs, or over 25 per cent. In 1886 the maximum production of 8,160,973 kegs was reached. In 1898 the production of wire nails exceeded the production of cut nails by 5,846,254 kegs. In 1897 the wire nail production exceeded the cut nail production by 6,890,446 kegs.

NATIONAL TUBE CO. ORGANIZED.

The consolidation of the wrought tube and pipe companies of the country, which has been under negotiation for some months by Wm. N. Cromwell, and Edmund C. Converse as consolidation purchasers, representing J. P. Morgan & Co. and the largest wrought pipe interests, has been effected. Officers were elected on Thursday, May 25. The properties were examined by Jones, Caesar & Co., chartered accountants, and by Julian Kennedy and Robert Forsyth, as mechanical and construction experts. The properties taken represent about 90 per cent of the producing capacity of the country. They are as follows:

National Tube Works Co., McKeesport, Pa. The various furnace, steel works, rolling mill and galvanizing plants of this company are these: Monongahela Furnaces—Two stacks, 80x20 feet, and 80x19 feet; annual capacity, 240,000 tons of Bessemer pig iron. Rolling mill department comprises the National Rolling Mills, the National Forge & Iron Works (exclusively charcoal) and the Boston Iron & Steel Works. Total annual capacity 180,000 tons of pipe iron and steel. The tube works proper have an annual capacity of 250,000 tons of wrought iron and steel pipe, sizes from ⅛-inch to 36 inches. The Bessemer steel department has two 8-ton converters. Annual capacity 225,000 tons. The Republic Iron Works department at 25th st., South Side, Pittsburg, has an annual capacity of 37,000 gross tons of boiler tube and pipe iron, 7,300 tons of sheet iron, and 7,000 tons of plate. The National Galvanizing Works, located at McKeesport, are also a connected interest of the National Tube Works.

Riverside Iron Works, Wheeling, W. Va.: Riverside Furnace, Benwood, W. Va., 75x17 feet, annual capacity 80,000 gross tons of Bessemer iron. Steubenville Furnace, Steubenville, O., 75x16 feet, annual capacity, 65,000 gross tons. Plans made for new furnace at Benwood. In connection with the furnace at Benwood are 60 Semet-Solvay by-product coke ovens. Tracts of coking coal lands have been acquired in the Connellsville region. Bessemer steel works have two 5-ton converters; annual capacity, 150,000 gross tons of ingots. Rolling mills produce annually 125,000 tons of finished bar steel, tack plate and skelp, and nail works 550,000 kegs of cut nails. Annual capacity of wrought iron and steel pipe, 90,000 tons.

Pennsylvania Tube Works, Pittsburg. Works at Soho. Annual capacity of wrought iron and steel pipe, ⅛-inch to 12 inches, 150,000 tons.

American Tube & Iron Co. Middletown, Pa., works have annual capacity of 130,000 tons of wrought iron pipe, ⅛-inch to 30 inches. Youngstown, O., works have an annual capacity of 30,000 tons of wrought iron pipe, 1½-inch to 20 inches.

Chester Pipe & Tube Co., Philadelphia, Pa. Works at South Chester have an annual capacity of 70,000 tons of wrought iron and steel pipe, 1½-inch to 20 inches.

Oil City Tube Co., Oil City, Pa. Annual capacity of wrought iron and steel pipe, sizes up to 12 inches, including riveted steel pipe, 50,000 tons.

Cohoes Tube Works, of Aird, Don & Curtis, Troy, N. Y. Works at Cohoes have annual capacity of 12,000 tons.

Syracuse Tube Co., Syracuse, N. Y. Annual capacity 22,500 tons, sizes from 1¼-inch to 8 inches.

Allison Mfg. Co., Philadelphia. Wrought iron pipe and boiler tubes. Capacity not stated.

Delaware Iron Co., New Castle, Del. Morris Tasker & Co., Inc., Philadelphia, sole agents. Annual capacity, 75,000 tons of wrought iron and steel pipe, sizes ⅜ inch to 16 inches.

Ohio Tube Co., Warren, O. Annual capacity, 40,000 tons. Sizes from ¼-inch to 6 inches.

Oil Well Supply Co., (Continental Tube Works), Pittsburg. Annual capacity, 50,000 tons. Sizes from ⅛-inch to 12 inches.

Officers of the new company have been elected as follows: President, Edmund C. Converse; chairman of the board, Joshua Rhodes; first vice-president (in charge of manufacturing), F. J. Hearne; second vice-president (in charge of mercantile affairs), Horace Crosby; third vice-president, Francis L. Potts; general manager (manufacturing department), A. S. Matheson; treasurer, New York, (A. F. Luke, of Boston, is being urged to accept this place, and he has the matter under consideration); assistant treasurer, Pittsburg, Wm. H. Latshaw; general counsel, Sullivan & Cromwell. Directors—Joshua Rhodes, J. J. Vandergrift, William B. Rhodes, F. J. Hearne, J. N. Vance, John Eaton, Francis L. Potts, F. R. Tobey, Jonathan Rowland, Daniel O'Day, A. S. Matheson, O. C. Barber, Henry Aird, John Don, Edmund C. Converse, Horace Crosby, Wm. Nelson Cromwell, D. W. Hitchcock, A. F. Luke, W. J. Curtis.

The examination of plants and of books was rigid and exhaustive, and plants not coming up to the requirements of the examination were rejected. It is stated that the stock to be offered, in addition to that used in the acquisition of the various plants has been subscribed five times over, though books have not yet been opened. The total output of the various plants is about 1,200,000 tons a year. The National Tube Works Co. is the largest steel tube company in the world. It has 8,000 names on its pay roll. It is capitalized at $11,500,000. Of the other companies the largest are the Riverside Iron Works, capitalized at $3,000,000, the Pennsylvania Tube Co., at $2,000,000, and the American Tube & Iron Co., at $1,000,000. The financial and official headquarters of the new company will be in New York and the manufacturing headquarters in Pittsburg.

Personal.

James Bowron, vice-president and treasurer of the Tennessee Coal, Iron & Railroad Co., has gone to England on business.

Richard F. Gurney, of the London office of the Carnegie Steel Co., Ltd., formerly an attache of the American Embassy in London, has been spending the past month at the various plants of the Carnegie company at Pittsburg.

Frank N. Winne, for 15 years in the employ of the Crane Co., Chicago, for several years past manager of the railroad department of the company, died at his home in Evanston, Ill., May 29, of pneumonia, aged 41 years.

In addition to announcements already made concerning official positions in the Republic Iron & Steel Co., are the following: C. I. Rader, of Sharon, Pa., heretofore furnace manager for Pickands, Mather & Co., of Clevelnad, is made manager of all the blast furnaces of the new company, the appointment effective June 1. Joseph M. Butler, formerly assistant secretary of the Brown-Bonnell Iron Co., has been put in charge of the distribution of the products of the various mills. Wm. F. Bonnell, treasurer of the Mahoning Valley Iron Co., has been appointed sales agent, with headquarters at Cleveland. Henry Heedy, formerly secretary and treasurer of the Andrews Bros. Co, Youngstown, O., has been appointed district treasurer, having in charge the finances of the mills in the Mahoning Valley, his headquarters being in Youngstown.

Proposed Foundry Supply Consolidation.

It is reported that a combination is being agitated among the manufacturers of foundry facings and other foundry supplies. It is stated the capital stock will be $2,000,000, and the concerns mentioned in connection with the proposition are J. S. McCormick & Co., Pittsburg; S. Obermayer Co., Cincinnati, O.; J. W. Paxson, Co., Philadelphia; T. P. Kelly & Co., New York; Buffalo Foundry Supply Co., Buffalo; Cleveland Facing Mills, Cleveland; J. D. Smith Foundry Supply Co., Cincinnati, and the Hill & Griffith Co., Cincinnati.

The W. F. Robertson Steel & Iron Co., Cincinnati, has been appointed Cincinnati agents of the American Steel Hoop Co., with the surrounding territory in Ohio, Indiana and Kentucky as tributary to the agency.

AN UPPER-FLOOR FOUNDRY FOR LIGHT CASTINGS.*

BY C. J. WOLFF.

In the evolution of foundry practice, much good has resulted from the meeting of foundrymen, in convention and in local associations, in exchanging experiences in the various details of founding. The foundry of ten years ago was conducted on more selfish principles than that of to-day, much to the disadvantage of the proprietor of such an establishment. It properly becomes each of us to contribute to the store of useful knowledge and experience, and as we think our iron foundry a departure from the ordinary practice followed, I thought it might be found interesting to some of you to hear and know about an iron foundry melting 70 to 80 tons per day, with a clear molding floor of 125 feet by 540 feet long, located on the third floor. The foundry, being above the housetops in the neighborhood, always has unobstructed light, and the air is so pure that in summer the birds seem to think it a nice place to perch on the beams of the roof construction and watch the molders, while singing their songs to an appreciative audience. The molders do not leave their work so frequently for refreshments, and are not disturbed by visiting friends and inquisitive strangers. The dampness arising from ground molding floors, which is often the cause of rheumatism and colds, is avoided. The smoke and steam incident to starting the cupola and casting iron are quickly dissipated by the breeze that has unobstructed passage through the windows, and being so high above ground does not bother people living in the neighborhood; making it at all times a pleasant place to work in.

The building is of mill construction; the foundry floor consists first of a 3-inch matched floor on the joists; above this is a coating of tar paper, then a cedar block pavement 4-inches high, bonded together and filled with tar and gravel, in the usual way you have seen them laid on our city streets. The molding sand covers this, the dampness of which is sufficient protection. This forms the molding floor. The floor around the cupola is made of steel beams for joists, with brick arches between same; this is covered with an ash cement and makes a floor upon which the bottom of cupola can be dropped without any danger of fire.

The cupolas, of which there are two, are situated near one side of the foundry at about equal distance from each other and from the ends of the building. The cupolas stand on foundations of brick, built up from the ground, which are used for vault purposes on the lower floor. The charging floor or scaffold is of iron on steel beams, large enough to hold pig iron and coke for the day's melt, which is taken up in the forenoon, so when the blast is on, the charging is done with ease and dispatch. The blowers are placed on the ground floor with the blast pipes running up to the cupolas. The jarring effect, caused by charging of the cupola, and the vibrations of blowers, having no bearing on foundry floor, do not in the least jar the molding floors.

The foundry is built with clear story in the middle, as most foundries are now put up. The roof is supported by steel truss work with a span of 60 feet in the middle of the transverse section, thus leaving 32 feet on each side of the trussed section. The posts in the foundry, supporting the trussed roof, are of cast iron, and do not interfere with molding floors, as they are alongside of the gangway. These iron posts also support an overhead I beam tram rail, on which the trolleys which carry the bull ladles travel, for distributing the molten iron to the molders throughout the foundry. This track system is so constructed that iron can be taken from one cupola to either extremity of the foundry. One man can with ease pull a ladle holding 800 pounds of iron.

This system of handling iron does not jar the floors. The steam elevators deliver pig iron and coke to the charging floors of the cupolas, and the trip from the ground floor to the scaffold does not take much longer than to hoist material from the ground to the scaffold of a cupola in a foundry situated on the ground floor. Iron and coke can be piled contiguous and easy of access to the elevators.

The castings are taken down to the cleaning room on a belt elevator on the opposite side of the foundry. The molders put up their work in the morning and early afternoon, and after pouring off, they go home. A night gang shake out castings and wet down sand. When the molder comes to work in the morning his sandheap is ready for him, and the castings have all been taken away in hand trucks early in the morning; each truck holding the castings made by one molder. The castings are checked up on leaving the foundry and again in the cleaning room. There is a steam elevator back of eachcupola, and one belt-driven one. These three elevators take care of all the castings, new molding sand, pig iron and coke, together with the needs of the departments on second and first floors.

There are a large range boiler and tank shop and machine shop and other works connected with the preparation of castings for enameling, on the second floor. These departments are never troubled by dropping sand or by smoke or steam from the foundry, thus making this second floor as good for any use as if there were no foundry above it. The first floor is used for finished stock, shipping room, rattle room and enameling shop. A basement at one end of the factory contains winter supply of sand. There are no long hauls in disposing of castings from the foundry. They simply need to be lowered, which does not take much power. We make castings up to 800 pounds in weight, using a number of three-ton traveling cranes. Incipient fires are very unusual, and we do not think our foundry at all dangerous. Our insurance rate for the foundry is not increased by reason of our location.

We have a pattern house across a 16-foot alley, connected with the foundry by an iron bridge. We had a disastrous fire some years ago on a Christmas eve—its origin was unknown. Some heavy wooden truss work holding the roof spans contributed to the spread of the fire, and the 4-inch water main in the street proved wholly inadequate as a supply. The pattern house, which contained all our master and many working patterns, was not burned, which proved a blessing in our misfortune. In rebuilding we used iron roof construction and effected some other improvements, such as building two fire walls with iron doors, thus dividing the building into three sections but while working, practically one large room.

Having started this style of foundry 18 years ago, as an experiment, much to the amusement of our neighboring foundry friends, we found it to have so many advantages that when 12 years ago we needed a larger foundry, we built our present one, and have since had many inquiries from people contemplating building new foundries, many of whom have followed our example. Among the advantages we consider we have are the great economy in ground covered, the protection against obnoxious and intrusive visitors, the inconvenience for the men to leave their work readily, and also the means afforded for better light and air.

* Read at the Pittsburg meeting (May, 1899) of the American Foundrymen's Association.

M. J. O'DONNELL & Co., 18-26 Johnson st., Cleveland, are builders of electric, hydraulic and steam passenger and freight elevators. They commenced this line of work in 1888, since which time they have increased their capacity and now have all facilities for the best of work. They are at present making six different type of electric and four type of hydraulic elevators. Special success has been attained in their alternating electric current system, which is now installed in many high buildings, showing good results in action, control and economy. Recent contracts include three elevators for Goldsmith, Joseph, Weiss & Co., Wyandotte apartment house, 8-stories; DeKlyn apartment house, 7 stories, alternating current system; James Leighton, 6-story apartment house, alternating type; City Hall, Elmira, N. Y., direct current; H. B. Perkins, 6 story building, two direct current elevators, one of 9,000 pounds capacity, platform space 8x16 feet, constructed for handling machinery for Strong, Carlisle & Hammond; hydraulic engine and elvator in Blackstone Building; two hydraulic elevators for Standard Block. The firm has a large amount of work ahead and is working up to the capacity of its shop.

THE Tidewater Steel Co. has filed notice at Harrisburg that it has increased its capital from $1,000,000 to $1,500,000. There has been no active work at the mills at Chester, Pa., acquired by the company and the active speculative trading in the stock of the company at Philadelphia is inexplicable to people who see no signs of activity about the plant. Recent sales of the stock at Philadelphia have been at 8 to 9.

MODERN FOUNDRY BUILDINGS.*

BY ARMIN SCHOTTE.

Money saved is money earned, and this old saw is being continually exemplified in new ways. In a foundry an account can be kept of every pound of material entering the cupola and every pound of salable material which comes out of it. All other items which affect the cost of the finished product can be readily recorded and comparisons and experiments made to either increase the quality and quantity or reduce the cost. Supposing the foundry to be a most modern one, having a machine shop connected with it, the performance of different tools for doing the same class of work may be judged in the same way, although a much longer time is usually required to do this. A foundryman soon becomes very expert, and with the means at hand turns out a maximum product at a minimum of cost for his particular establishment.

Raw materials can be easily changed and tools rearranged to suit the occasion, but the defects in a building once up can not be remedied without serious interference with the work, and added expense. How many foundrymen have ever considered that their building besides being merely a covering to keep off the weather is to a certain extent also a tool, and requires the special knowledge of a skilled engineer for its economic design. The foundryman creates the conditions he wants fulfilled and the specialist fulfills them.

It is at once apparent that since the advent of overhead traveling cranes the whole structure has become a part of this tool, the columns being necessary for its support and the trusses being braces for the columns. The conditions to be met here now are naturally very much more complex than formerly, and the results which might happen if the design of a structure carrying several cranes of 30, 60 or even 100 tons capacity, were left to inexperienced hands are too awful to contemplate.

Look at many of the former buildngs put up at different times during the last 25 years and you wonder how it is possible for a molder to set his pattern into the sand so as to get a good casting. It is very evident that the subject of ight has in these cases not been properly treated, for even if a certain number of windows and skylights have been provided, they have mostly been poorly distributed, the areas lit up by each very often overlapping to a considerable extent, or they have been so placed that to clean them conveniently is sometimes next to impossible. A great help in having clean windows is to keep them as much as possible from becoming dirty. In a foundry with its gases and dust good ventilation does this.

It is very apparent that the labor cost in a dark building will exceed that in a well ligted one, for men can work faster in the latter. By saving time on each operation the foundryman is enabled to use the floor space oftener, and the output is thus increased. The matter of the building, its size, arrangement and structural features are therefore very important.

Although the effect on the cost of finished product, of a building in whose design the features mentioned above have been well taken care of, can only be approximated, estimate can be made on the first cost of construction, which determines such fixed charges as interest on the capital invested, insurance, cost of repairs and charges toward sinking fund.

When the variety of building material was limited to a few articles, the choice was easy, but at the present time the number of articles offered in the building line are almost bewildering and it requires an expert to separate the wheat from the chaff. In such large foundry buildings as those of the Westinghouse Air Brake Co., McConway & Torley Co., and the new works of the Mesta Machine Co., at West Homestead, the quantity and cost of each separate item is considerable, running up to many thousands of dollars in each case, the total footing up to a good-sized fortune. It is obvious that the selection and disposition of these things should not be left to interested parties, whose judgment is affected by the possible benefits their bank account may derive for the time being. That construction is the most economical which with a minimum cost of material is the most lasting. Iron and steel have taken the place of wood wherever possible. The conditions which have brought about this change are too well known to need recounting here. The iron-clad building of to-day is a construction which commends itself principally on account of its low first cost, fire proof qualities and ease of erection. It also requires no separate foundations for the side walls. The material used is corrugated iron or steel, either black or galvanized. If black, a protective coating of paint is absolutely necessary, and it is usually put even on galvanized iron.

The objections which can be urged againt this construction are the short life of the covering, despite the constant and costly attention to preserve it and keep it in repair, and the poor protection it affords against changes of temperature. This changing temperature is its worst enemy, for the moisture which condensed on the surface as the atmosphere cools off will reach the metal through the innumerable small cracks caused in its protective covering by constant expansion and contraction. If this moisture is charged with acid gases, as is the case in a foundry, the final result is hastened. Corrugated iron or steel is not the most economical covering for a foundry building.

For side walls and partitions a most excellent material is brick, and as the now usual steel skeleton construction does not require them to act as supports for the floors or the roof, they may be made as thin as will insure their stability against the effects of constant vibrations due to the passing of railroad trains, for few foundries are very far from the main line, and the machinery of the plant. It is poor economy to use anything but the best cement mortar for joints. For the roof covering only a good quality of slate should be used. This should be laid on good stiff wood sheathing, preferably flooring which is covered with a layer of first-class roofing felt, or it may be wired to steel slating angles put about 10 inches apart. This latter construction is more costly than the other, but there is no danger of fire.

It is a curious fact that in different parts of the country different styles of factory buildings prevail for one and the same kind of manufacturing. This is due in a certain degree to the conservatism, not to say ignorance, in many cases, of owners who have accepted as good a certain pattern of their neighbor, and who do not trust their judgment with regard to offered improvements. Pittsburg is happily a rare exception to this practice, for the success of Pittsburg's manufacturers is due to their progressiveness and willingness to try anything whichhas a reasonable chance of being a success.

The writer has been enabled recently to put up what fulfills to the greatest degree all conditions required of a good construction. It is called the "cementine" construction, because, although the framework of the building consists of steel as usual, the covering is made of steel embedded in concrete. The material used in the concrete is boiler cinder, sand and cement. It is possible in this manner to construct walls with a thickness of two inches which combines all the best points of an ordinary brick wall, and a roof not exceeding three inches.

This system admits of the omission of the usual wall foundations, and a wall 40 feet high is no thicker and no more expensive per square foot than a wall 10 feet high. The construction is absolutely fire-proof, does not sweat and is warmer than a brick wall because less porous and a poorer conductor of heat. The construction is not new in principle, but has stood the test of time, only the manner of its application being novel. It is to the writer's mind the ideal construction for foundry buildings, for it combines low first cost with strength, the cost not exceeding that of any other first-class construction, while it is absolutely fire-proof, the repairs are nominal, it will outlast any other construction, and it makes a pleasing appearance.

Discussion.

Mr. Schotte stated that he had read the paper merely as an outline, or preparation for a discussion relative to the construction refererd to. He exhibited photographs showing the Walker soap factory, and other buildings, erected of this construction. The principle is that of making a frame work composed of either expanded metal lath, or wire lath, on which the cementine is built up, the thickness being say two inches. For floors, heavy expanded metal is used; for roofs, it is used lighter, while for sides it is lighter still, and of finer mesh. The wire lath which is used sometimes is stiffened in

* Read at the meeting of the Pittsburgh Foundrymen's Association, Monday evening May, 23, 1899.

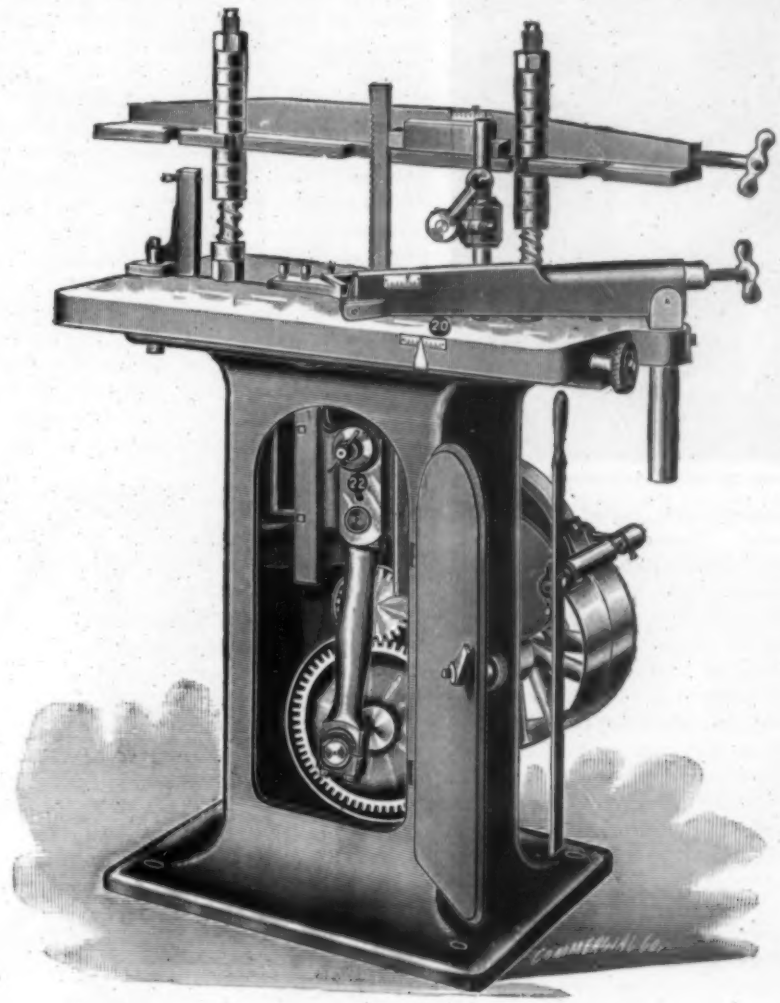
one of two ways: By round rods woven into it, spaced 16 inches apart, or closer, or by heavy gauge sheet steel strips, bent into a V-shape, and spacedin the same manner. The first cost is not cheap, although the cost of material is not much, but the labor involved in erection is considerable. But the construction is considered cheap in the long run because it is practically everlasting. It will stand intense heat, and when hot may have water sprayed on it. Pieces have even been made so hot that the steel inside fused, and these pieces have then been thrown in water, without being cracked. On account of its being a very poor conductor of heat it will not sweat. A case was mentioned of a large building, just being completed, in which there were a 4-inch and 2½-inch steam pipe, used for power in some erecting work. There was a heavy fall of snow, and the heat of the roof, derived from these steam pipes, was sufficient to melt all the snow, so that there was no snow left on the roof except at the eaves, although the fall amounted to 8 or 10 inches.

Mr. Seaman asked if this material had ever been used for a machine shop floor or where other heavy work was done, and it was answered that it has been used as a floor in a brewery, where heavy barrels were being rolled about, and that one of the barns of the Consolidated Traction Co. had a floor of this material, on which a car had been run. It is stiff, yet elastic. With a good-sized span, a marked deflection can be noticed with a heavy load, yet it returns back to its place when the load is removed. In erection it is necessary that the arrangement be such that the steel is placed in tension and the cement in compression, because the cement has very little tensile strength. The result is that when something has to give, it is the steel which yields because its tensile resistance is less than the compressive resistance of the cementine. In roofs the panels are usually of 10 feet span, the cementine being 3 inches or 2½ inches thick, and it may be struck with a sledge without damaging it. The proportions in making the cementine are one part of cement to 1, 2, 6 or 7 parts of clinkers, according to the size and condition of the latter. Mr. Seaman recalled a road which he had built of blast-furnace slag, using heavy pieces first and covering these with finer. In three or four years it was necessary to take this up, and it was necessary to use powder, as the whole had become thoroughly cemented together.

THE DAVIS IMPROVED KEY-SEATER.

The W. P. Davis Machine Co., Rochester, N. Y., manufactures a key-seater that has been very extensively sold in the past 18 years. It is known as the manufacturer's No. 1 key seating machine and will cut seats from ¼ to 1 inch. The machine is complete with heavy clamping bar for large work, also special clamping lever for small work, and it will perform all operations accurately and quickly. The feed has automatic relief which prevents the breaking of cutters, and is intended for all machine shops having internal key-seating to do. The depth and taper of key-seats are measured accurately by scales and pointers, and any number of key-seats can be cut of any given depth and taper.

The accompanying illustration indicates the construction of the machine. The table has an adjusting screw at the right, to give the proper taper to the key-seat. The support



ing bracket, for sleeve cutting, is seen on the left side of the table, with adjusting screw at the top for supporting the work. Above the table and parallel to it is a clamp for holding heavy work, such as pulleys and spur and bevel gears. Midway is the cutter bar for cutting the key-seat and on either side are clamping studs for holding work, with collars for regulating their height. Two feed screws with automatic relief, are shown at the right, the lower one adjusting the clamp arm for holding small work. At 20 is shown a scale for adjusting the taper for the key-seat. The scale just above it has graduations for the depth of the key-seat. At 22 in the under working parts is the cross head clamp for holding the cutter in place. Large numbers of these key-seaters are in use in the United States and in foreign countries.

Stanley Flagg & Co., of Pottstown, Pa., have announced that wages of molders will be advanced 10 per cent. beginning June 1.

ORIGINAL METHODS FOR HANDLING MATERIALS AT THE WORKS OF THE MICHIGAN STOVE CO.

BY W. J. KEEP.

[Below is the concluding portion of Mr. Keep's paper. The methods of handling pig iron, coke, sprues, and sand were described last week.—Ed.]

No scrap iron is used, and the mixture is No. 1 soft, No. 2

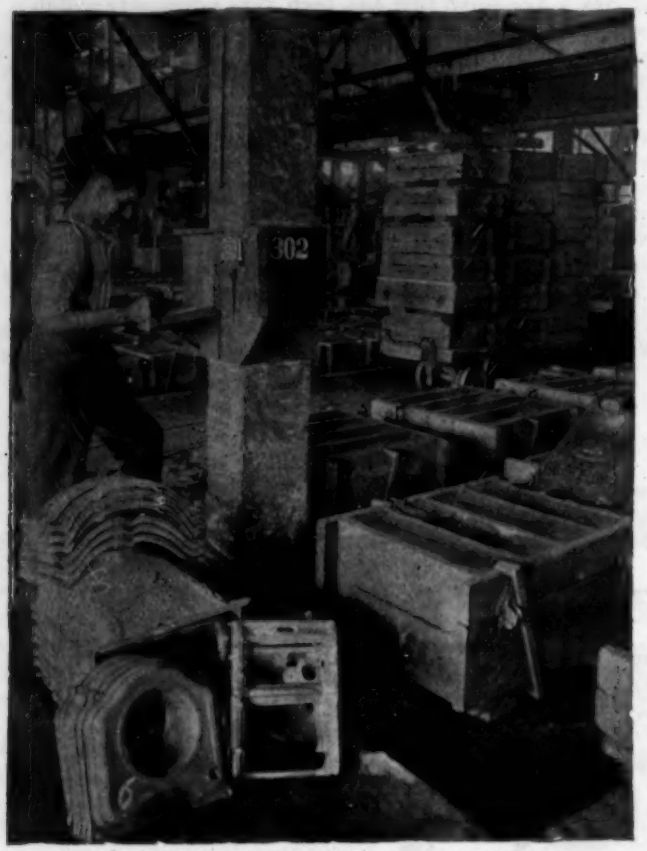


FIG. 6.—MOLDER MAKING RECORD OF HIS CASTINGS.

foundry, No. 4 foundry, and a silvery iron varied in proportions to keep the quality uniform. There are three sets of piles containing these four irons. Each grade of pig iron is placed in a pile nine feet wide and 50 feet long. A car can be placed centrally on the top of any one of these three sets of piles and with a very few steps the loader can take the required number of pigs of each kind of iron and pile them at the central part of the car. The product has been more uniform since mixing iron in this way than when left to the caprice of a melter. The total weight of pig iron and of coke is accurate, and there is, therefore, no discrepancy between weights of material purchased and of castings produced. The remelt is also accurately weighed and the ratio of fuel to iron is accurate. By placing one complete charge on each car and keeping tally with pegs at weigh house and at cupolas no mistakes can be made.

At present we have No. 1 cupola lined to 68 inches and No 2 cupola lined to 62 inches and both are driven by a single No. 7 blower, which has been used 18 years. This blower when new was rated to melt 14 tons per hour, but the two cupolas now melt 20 tons per hour with the single blower. We have purchased a new blower of a capacity that will melt 30 tons per hour, which will deliver the iron as fast as the men can carry it away, and will give a continuous stream.

Recovery of Iron from the Cupola Cinders.

When all these devices were in working order it was found that the picking over of the cupola bottom and separating unburned coke and large pieces of iron, and taking cinder to, and running it through the cinder mill, and back to the weigh house, took more time and power than any other operation connected with the cupolas, and to save this the followng plan was adopted: After the last iron has been drawn from the cupola at night the breast is knocked in and the slag runs out on the floor, a dam of sand keeping it from spreading. Iron that comes out with the slag forms a thin slab on the ground, which can be separated when cold so that not a particle of iron will be lost. When the bottom is dropped it is composed of unburned coke, unmelted pigs and small pieces of iron, much of which has run into the coke, and some bits of slag and iron mixed, but nothing is cemented together, because the slag has been drawn off.

In the morning the pieces of sand bottom are picked out. The rest is quickly shoveled into cars and run out on the central yard storage track. The sculls from ladles are thrown into the same cars, as there is considerable iron adhering to them. These cars are stored during the day on the central storage track, and follow the car containing the last cupola charge and the contents is dumped on the cupola platform. The chargers have nothing to do for an hour after the last charge is on, and they with forks carelessly shovel to one side unburnt coke, and to another place iron and cinder, and to another place unmelted pigs or iron. The cinder and small particles of iron and iron from gangway sweepings, are thrown on the last change. Then the fine material that could not be taken up with the fork is riddled and that which is retained in the riddle is thrown in the cupola. The pig iron that drops with the bottom must be charged next day with enough unburned coke to melt and the rest of the unburned coke can be used as the melter chooses. Both iron and coke having been weighed the previous day, should not be weighed again.

Iron borings or other fine scrap can be put on the last charge before any of the cinder is charged. As soon as the cinder is in the cupola, the iron at the tap hole is perceptibly hotter. The cinder being wet acts like the wet covering over a blacksmith's fire, the blast being held down, and every particle of iron and slag ar melted out and a cover of hot fine coke is left. The iron and slag are drawn out when the breast is knocked in.

This fine coke is returned each day to the charging door and the melter has quite a quantity to use when he thinks a little extra is needed. This dispenses with all cinder mills, power and repairs, and labor connected with them, and saves all the fine coke and iron that was formerly carted away as mill cinder. It saves every particle of iron from every quarter

FIG. 7.—MACHINE FOR PULLING NAILS.

and prevents material blowing out of the cupola during the last of the heat and lodging on the foundry roof. It costs nothing to sort the bottom after the last charge is on, whereas sorting in the morning must be paid for. We also contem-

*Read at the Pittsburg meeting (May, 1899,) of the American Foundrymens' Association.

plate enlarging the tap hole, so that all iron and slag will run out of the same hole, the slag to be skimmed from the iron and conducted through a side spout to a wheelbarrow, which will be taken away as fast as it is full.

Keeping Account of Molders' Work.

Fig. 6 is a view of a molder's folding desk. Two other desks are closed. The method of keeping the molders' piece account is peculiar. Each molder has one of these folding

FIG. 8.—SCREENING SWEEPINGS FROM GANGWAYS.

desks in which is placed a sheet on which is written the name of each piece that the molder has on his floor, the number he is to make each day, and if it does not run steady the total number to be made. When a molder has shaken out his work he makes separate piles of each kind of castings and marks with chalk on the top of each pile the number of perfect castings. He also marks on his slip the same number. In the morning the castings are wheeled to the cleaning room by contract and a clerk goes down each gangway immediately ahead of the wheelers and compares the numbers on the slip and on the pile and counts each piece and examines closely enough to see if the piece is recorded correctly. He then carries with him the slip, which, when he has collected a sufficient number, he sends to the time keeper's office, when the account is transferred to the regular books. This is completed about 10 a. m., when the books and slips are taken to the discount room, and all discount is entered by marks on the slips and also on the book. The slips are then placed again in the molder's desk, when he can see what discount he has, and from 12 to 2 can inspect it, but cannot take it from the room. If there is any piece that can be made good or should not have been discounted the molder can place it on a table and call the foreman's attention, who can allow it to be fixed. Each molder is furnished with a stamp containing his check number, with which he stamps each mold. In this way each casting contains the molder's number and no mistake can be made in discounting. In figuring up a pay the molder's account is figured separately on the slip and on the book, which checks all operations, and there are never any disputes regarding mistakes in counts. The molder knows exactly what he is earning each day.

On each side of the discount room are bins, each holding the discount of three floor molders. At the center of the room are smaller bins holding the work of three snap molders. This discount is loaded on cars at 2 p. m. and taken to the weigh house.

Economizing Features.

Fig. 7 is a view of a machine for pulling nails. It will pull 75 nails a minute. On the other end of this machine is a trip hammer, under which the nails are placed to be straightened. It costs to pull, brighten in a tumbler, straighten and assort nails, 50 cents per keg, and they are as good for the molders as new nails. All nails are taken from old bars, and the bars are then used over again, making a great saving in nails and lumber. On the lower floor are stored all straight flasks and the bars are changed to fit different jobs. On the second floor are kept all cut flasks, those for each stove being piled together.

Fig. 8 shows a screen with the crane dumping a carload of sweepings from the foundry gangways. The sand falls through and is removed by a cart, while the iron runs into the box at the lower end of the screen. As soon as the sweepings are all dumped the crane lowers the box to get the iron, which is taken to the weigh house.

Fig. 9 shows a winch for moving steam cars on the main railroad track. At the other end of the track is a sheave around which runs a ⅝-inch steel wire cable, each end of which is wound around one of the drums of the winch. One of the drums runs at twice the speed of the other, and one drum is free to unwind as the other winds the cable. At one point in the cable there is a link into which is hooked the end of a chain, the other end of which is attached to a car. An electric signal tells which rope to wind and when to stop. The motor of the winch is 8 h. p. and will move on the straight track several cars. It takes one man at the coupling and one man at the winch to move a car or to make up a train. This same winch will be used at a future time to run some kind of coal conveyor to a receiving bin over the boilers, which are already fitted with Murphy smokeless furnaces, which have hoppers for self-feeding from this storage bin, but thus far no satisfactory conveyor has been found. Having electricity, all parts of the works are lighted, saving over $50 each month during a good part of the year in gas bills.

The cost of the apparatus described was about $16,000, which included electric generators and the flask building. We were not able to unload material from steam cars as we had calculated and the 60 cars which were purchased were all needed in handling cupola material and flasks. Therefore the tracks and cars have not been used to take castings from the foundry to the cleaning room, and for this reason one-half of the tracks are not yet used. We expect to construct a cross between a car and a wheelbarrow by which one man

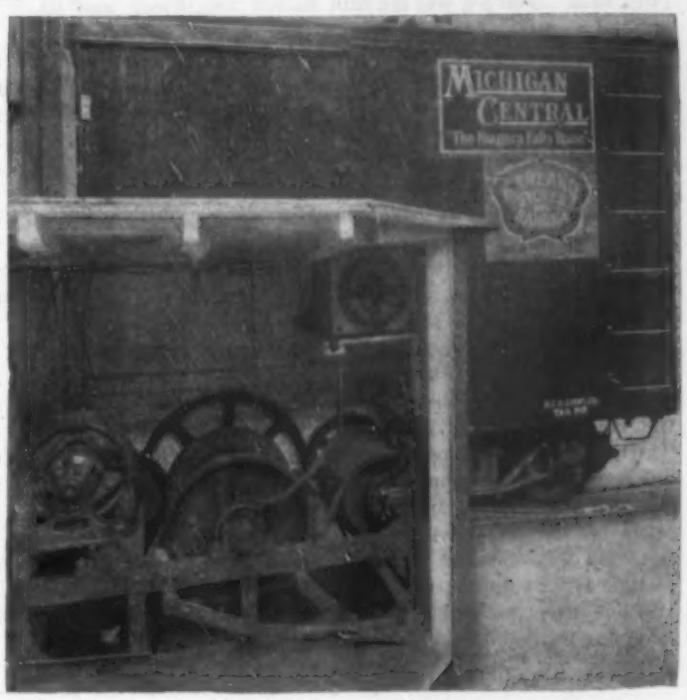


FIG. 9.—ELECTRIC WINCH FOR SHIFTING RAILROAD CARS.

can take half a ton or a ton of plate on the tracks to the cleaning room as quickly as he can now wheel 500 pounds, in which case he would expect to do such work at night, so as to have all gangways cleared and cleaning mills loaded at night. For various reasons we have not saved half the labor that we anticipated, and we expect to do much better in time. As it is, the saving is such that after setting aside $1,000 each year for interest on the investment, we shall pay for the whole investment in three years with the present saving.

PIG IRON ANALYSIS.

Results of Different Chemists from the Same Piece of Iron.

BY EDMUND E. JOHNSTON.

[Our readers will recall the discussion in these columns something more than a year ago, on the occasional divergent results of analyses of samples from the same piece of pig iron. The appointment of the American Foundrymen's Assocation's committee on standardized drillings resulted from this agitation. In the past year Mr. Edmund E. Johnston, chemist of the Ashland Iron & Steel Co., Ashland, Wis., has been at work on the matter and presents the results in a pamphlet just issued by his company, which we reprint almost in full below.]

I read with a great deal of interest Mr. Thomas D. West's article in *The Iron Trade Review*, of April 14th, 1898, entitled, "Need of Greater Uniformity in Pig Iron Analysis," also the discussion in the preceding number, "How to Secure Uniformity in Pig Iron Analysis." It is the writer's belief that the variations in the different results obtained by Mr. West are not wholly due to the methods of analysis, but largely to discrepancies in the samples themselves. The most important point is in taking the samples for analysis. If more care were exercsed the chemist would not obtain such discordant results.

It is a very difficult matter to mix and sub-divide a large quantity of pig iron borings so that the various samples will check. Irregularities in the sample are inevitable. Having had practical experience along this line and realizing the importance of the questions raised, the writer issued a circular letter and sent out with it a carefully prepared sample of pig iron borings, to the chemists of a number of the blast furnaces and steel works. I asked that a complete analysis be made and reported to me with the methods used in each determination. Some fifty replies were received. They are interesting and suggestive. I have tabulated them, as shown on the following pages, and herewith present them for the consideration of the profession and as a contribution to the general subject of "Pig Iron Analysis."

These results were obtained from borings from a pig of our No. 1 "Hinkle" iron. The borings were taken with a ½-inch twist drill. The pig was cut into halves lengthwise, and its surface planed. The face of the pig showed no flaws, the iron being close and even grained. Borings were taken along this planed surface at intervals of every ½ inch, making two rows 1 inch part. Each sample, therefore, represents a hole ½-inch wide by 2 inches deep, and it weighs from 45 to 50 grammes. Without any further preparation each sample was put into a glass bottle, sealed, and marked according to the number of the hole from which it came. Fifty samples were taken altogether. It may, perhaps, be well to state that the results obtained by the chemists contributing to this paper were arrived at independently. It is therefore valuable and interesting, as showing that the method of grading pig iron by analysis is a reliable one when properly conducted.

By examining the tables it will be noticed that nearly all the chemists use the same method on silicon, and many use the same method for phosphorus, manganese, and sulphur. Thirty-eight use method A for silicon; two use method A3; one uses method A1; one uses method A2; one uses method A*; 17 use method B1 for phosphorus; 12 use method B; seven use method B3; three use method B2; two use method B4; one uses method B5; one uses method B1*; 29 use method D for sulphur; five use method D1; three use method D2; one uses method D3; one uses method D4. As for manganese, the methods are about equally distributed.

Importance of a Properly Prepared Sample.

There seems to be a great deal of feeling among the chemists generally in regard to the conclusion Mr. West drew from the report of his article of April, 1898, previously referred to. Some state that they refused altogether to work on his samples on account of the extraneous matter in it, as they could not check their results. Others say the sample was contaminated with much sand and rusted scale, but they made the analysis through courtesy, advising him at the same time that the result could not be relied upon. These extenuating points Mr. West does not give in his article. One can readily see by comparing our results with those obtained by Mr. West, that the samples must be carefully taken and prepared if uniform results are to be secured. From the results obtained by Mr. West and many others, one can see that his method of checking the accuracy of the chemist's work is open to much criticism. The want of strict homogeneity and uniform combination in the composition of an ordinary pig iron sample, may be very clearly shown by sifting the fine portions from the coarse. This was nicely demonstrated in Mr. Albert Ladd Colby's report in the *Iron Age*, June 2nd, 1898.

He got the following results by sizing a sample obtained by rapid drilling into the fracture of an open iron:

Portions remaining on	20-mesh sieve,			2.090	per cent. graphite.
"	between	20-40-	" "	2.100	" "
"	"	40-80-	" "	1.912	" "
"	finer than	80-	" "	2.684	" "

J. Parry and J. J. Morgan (*Industries*, Vol. 14, p. 90), in Mr. Colby's report of June 2nd, quote the following determinations made on drillings not carefully mixed:

Silicon	2.11 per cent.	1.74 per cent.	1.93 per cent.	1.70 per cent.
Graphite,	3.00 "	3.50 "	3.37 "	3.80 "

The writer prepared a sample of several ounces of drillings of pig metal, as sent out for analysis, and rubbed them up in an iron mortar sufficiently for all to pass through a 30-mesh sieve. The mass was then put into another sieve of 80-mesh and shaken to separate the fine from the coarse. About one-fourth passed through. Equal portions of the fine and the coarse were then carefully analyzed with the following results:

	COARSE	FINE
Graphite Carbon	1.376	6.862
Total "	.230	.350
Silicon	2.780	3.050
Manganese	.710	.760
Phosphorus	.200	.170
Sulphur	.014	.020
Iron	94.590	88.668
	99.900	99.880

Mr. P. W. Shimers' method of obtaining duplicate graphite determinations by first moistening the drillings of cast iron with alcohol has given me very good results. Another way which has given the writer very satisfactory results, is to take approximately the quantity of drillings desired for analysis, weighing and using all the drillings as they come from the pig, whether more or less than the desired weight. Of course this method can only be applied when you have a sample pig to work with.

Preparation of "Standards."

Our method of preparing a standard sample is to select a small pig and cut it down on a planer to about 6-in x4-in x2-in. Sample drillings are taken and put into glass bottles. This is

Methods Used in the Table.

A —Dr. Drown's. A°—Dr. Drown's modified.
A1—Si and P solution in HCl and HNO_3, evaporate to dryness; taken up in HCl; ignite and weigh silica.
A2—S. A. Ford's. A3—Solution in HCl, evaporate to dryness, take up with HCl, filter, ignite and weigh.
B —James O. Handy's B1—Emmerton's.
B°—Emmerton's modified. B2—Magnesia method.
B3—Weighing the yellow ppc. B4—International Steel Standard Com. method. B5—E. F. Wood's.
C —Volhard's. C°—Volhard's modified.
C1— Precipitating Mn in con. HNO_3 with $KClO_3$, making a basic acetate separation of the iron and weighing the Mn as pyro-phosphate. C2—William's.
C3—Ford and William's. C4—Julian's.
C5—Colormetric method C6—Gravimetric method (Blair's Chem. Anal. Iron, 3rd Ed.)
C7—Basic acetate, weighing as Mn_3O_4.
C8—S. A. Ford's.
D —Evolution method, titrating with iodine Solution.
D1—Bramble's. D2—Aqua-Regia method. D3—Dudley's.
D4—Gravimetric, by solution in strong nitric acid precipitation with barium chloride.
E —Combined carbon by subtracting the graphitic from the total carbon.
E1—By color, using standards of known per cent.
F —Solution in nitric acid, combustion in chromic and sulphuric acid.
F1—Solution in nitric acid, combustion in oxygen, using a platinum tube.
F2—Solution in hydrochloric acid, combustion in chromic and sulphuric acid.
F3—Solution in hydrochloric acid, combustion in oxygen, using a platinum tube.
F4—Solution in hydrochloric acid, combustion in oxygen and collecting gas in barium hydrate; ignite and weigh.
F5—Solution in nitric acid, weighing graphite on weighed filter.
F6—Koesten's.
F7—Solution in nitric acid, combustion in oxygen, collecting gas in barium hydrate; ignite and weigh.
G —Solution in double chloride of potassium and copper, combustion in chromic and sulphuric acid.
G1—Solution as in G, combustion in oxygen, using platinum tube.
G2—Solution as in G, combustion in oxygen, collecting gas in barium hydrate solution; ignite and weigh.
G3—The sum of combined and graphitic carbons.
G4—Regnalt's.

	Hole No.	Method	Silicon Details 1	Silicon Avge 2	Method	Phosph'r's Details 3	Phosph'r's Avge 4	Method	Manganese Details 5	Manganese Avge 6	Method	Sulphur Details 7	Sulphur Avge 8	Method	C. Car. Details 9	C. Car. Avge 10	Method	G. Car. Details 11	G. Car. Avge 12	Method	Total Car. Details 13	Total Car. Avge 14
Wm. Wilkins, Cleveland-Cliffs I. Co., Gladstone, Mich	1	A	1.285 1.28	1.2825	B1	.173 .175	.174	C	.33 .34	.335	D	.010	.010	E	.430	.430	F	3.59	3.59	G	4.02	4.02
Jno. P. Griffiths, Antrim I. Co., Maccona, Mich	2	A	1.28	1.28	B1	.176	.176	C3	.335	.355	D	.012	.012									
Jno. K. Mackenzie, Dickman & M. Chicago, Ill.	3	A	1.21	1.21	B1	.181	.181	C	.370	.370	D	.009	.009	E1	.380	.380	F1	3.850	3.850	G1	4.230	4.230
Cremer & Bicknell, Cleveland, O.	4	A	1.22	1.22	B2	.178	.178	C*	.38	.38	D2	.012	.012									
E. E. Johnston, Ashland I. & S. Co., Ashland, Wis.	6	A	1.24 1.26	1.25	B	.175 .175	.175	C	.37 .39	.38	D	.010 .012	.011									
Bertrand S. Summers, West. El'ct'c Co. Chicago, Ill.	8	A	1.19 1.21	1.20	B1	.179	.179	C4	.36	.36	D	.013	.013	E	.557	.557	F1	3.59 3.57 3.62	3.593	G1	4.15	4.15
Jno. L. Harvey, Homestead Works, Munhall, Pa.	10	A	1.27	1.27	B3	.176 .178	.177	C5	.33 .34	.335	D	.014 .016	.015	E	.91	.91	F1	3.050	3.050	G1	3.960	3.960
Andrew A. Blair, Booth, Garrett & B. Philadelphia, Pa.	11	A	1.320	1.320	B4	.162 .167	.1645	C6	.276	.276	D1	.025 .031	.028	E	.3620	.3620	F1	3.580	3.580	G1	3.942	3.942
Prof. E. D. Campbell, Ann Arbor, Mich.	14	A	1.30	1.30	B3	.180	.180															
F. A. Emmerton, Cleveland, O.	15	A	1.27	1.27	B2	.178	.178	C	.44	.44	D3	.003	.003	E	.62	.62	F4	3.80	3.80	G2	4.42	4.42
J. M. Camp, Duquesne Steel Works, Cochran, Pa.	16	A	1.28	1.28	B3	.175 .176	.1755	C5	.342	.342	D2	.009	.009							G1	4.220	4.220
W. E. Dickson, Spearman Iron Co., Sharpville, Pa.	17	A	1.24	1.24	B*	.175	.175	C*	.36	.36	D	.010	.010	E1	.45	.45	F5	3.54	3.54	G3	3.99	3.99
E. E. Johnston	17	A	1.29 1.31	1.30	B	.178 .178	.178	C	.34 .36	.35	D	.011 .011	.011	E	.437	.437	F	3.741	3.741	G	4.178	4.178
Hugo Carlson, Johnson Steel Co., Lorain, O.	18	A	1.31	1.31	B	.174	.174	C2	.30	.30	D1	.010	.010	E	.52	.52	F1	3.73	3.73	G1	4.25	4.25
H. M. Goodrich, J. A. & P. E. Dutcher Co., Milwaukee, Wis.	19	A	1.29	1.29	B4	.170	.170	C3	.30	.30	D	.011	.011									
Benedict Crowell, Cleveland, O.	20	A	1.25	1.25	B2	.180	.180	C	.34	.34	D2	.009	.009									
Warren R. Clifton, Shenango V. S. Co. New Castle, Pa.	21	A	1.296	1.296	B	.173	.173	C5	.355	.355	D	.011	.011	E	.381	.381	F6	3.775	3.775	G4	4.156	4.156
Frank E. Hall, Union Rolling Mill Co., Cleveland, O.	22	A	1.31	1.31	B	.172	.172	C	.39	.39	D	.009	.009	E1	.52	.52	F5	3.63	3.63	G3	4.150	4.150
E. E. Johnston	23	A	1.30	1.30	B1	.172	.172	C1	.35	.35	D1	.011	.011	E	.51	.51	F2	3.65	3.65	G	4.160	4.160
S. M. Rodgers, Oliver & Snyder S. Co. Pittsburgh, Pa.	25	A	1.297	1.297	B3	.178	.178	C1	.365	.365	D	.012	.012	E1	.48	.48	F5	3.671	3.671	G3	4.151	4.151
E. E. Johnston	26	A	1.26	1.26	B3	.178	.178	C1	.34	.34	D1	.011	.011	E	.45	.45	F2	3.710	3.710	G	4.160	4.160
Theo. Tonnele, W. Dewees Wood Co., McKeesport, Pa.	27	A	1.25	1.25	B	.178	.178	C5	.31	.31	D	.010	.010	E1	.35	.35	F5	3.77	3.77	G3	4.120	4.120
Dr. M. E. Rothberg, Cambria Iron Co., Johnstown, Pa.	29	A	1.30	1.30	B	.187	.187	C	.32	.32	D	.009	.009	E	.568	.568	F1	3.642	3.642	G1	4.210	4.210
W. B. Viets, Carbon Iron & S. Co., Parryville, Pa.	29	A	1.29	1.29	B1	.190	.190	C7	.35	.35	D	.012	.012				F5	3.80	3.80			
Oscar Textor, Cleveland, Ohio	31	A*	1.30	1.30	B5	.176	.176	C*	.33	.33	D	.006	.006	E1	.40	.40	F5	3.87	3.87	G3	4.370	4.370
Geo. P. Vanier, Steelton, Pa.	32	A1	1.33	1.33	B	.172	.172	C2	.29	.29	D	.009	.009	E	.289	.289	F1	3.825	3.825	G1	4.114	4.114
Fred H. Williams, Riverside I. Works, Wheeling, W. Va.	33	A	1.30	1.30	B	.180	.180	C2	.26 .25	.255	D	.010	.010									
C. C. W. MacPherran, Northwestern M. I. Co., Milwaukee, Wis.	34	A	1.32	1.32	B1	.175	.175	C4	.37 .38	.375	D	.014	.014									
W. L. Watt, Kittanning I. & S. M'f'g Co., Kittanning, Pa.	35	A2	1.260	1.260	B3	.183	.183	C*	.38	.38	D	.014	.014	E	.401	.401	F1	3.812	3.812	G1	4.213	4.213
F. E. Thompson, Embreville I. Co., Embreville, Tenn.	36	A	1.30	1.30	B1	.175	.175	C8	.30	.30	D	.011	.011	E	.47	.47	F5	3.70	3.70	G	4.17	4.17
S. B. Marshall, Dunbar Foe. Co., Dunbar, Pa.	37	A3	1.25	1.25	B1	.193	.193	C7	.439	.439												
Walter Wyckobb, Thomas I. Co., Hokendauqua, Pa.	38	A	1.32	1.32	B1	.182	.182	C3	.28	.28	D	.012	.012									
A. E. Outerbridge, Jr., Phil'd'lp'in, Pa.	40	A	1.38	1.38																		
Robt. M. Miller, Lucy Foe., Carnegie S. Co., Pittsburg, Pa.	41	A	1.28	1.28	B1	.177	.177	C	.36	.36	D	.010	.010	E	.45	.45	F5	3.76	3.76	G	4.210	4.210
Wm. A. Stephan, Warwick Iron Co., Pottstown, Pa.	42	A	1.28	1.28	B1	.170	.170	C	.30	.30	D	.009	.009	E1	.41	.41	F5	3.78	3.78	G3	4.190	4.190
R. S. MacPherran, E. P. Allis Co., Milwaukee, Wis.	43	A	1.31	1.31	B1	.174	.174	C4	.36	.36	D	.013	.013									
E. E. Johnston	44	A	1.30	1.30	B	.174	.174	C	.33	.33	D	.013	.013	E	.45	.45	F	3.722	3.722	G	4.172	4.172
G. L. Davison, Illinois Steel Co., South Chicago, Ill.	45	A	1.26	1.26	B	.170	.170	C4	.29	.29	D4	.009	.009					3.77	3.77	G1	4.12	4.12
W. P. Putnam, Detroit, Mich.	46	A	1.27	1.27	B1	.185	.185	C	.36	.36	D	.009	.009									
H. A. Knaus, Crane Iron Works, Catasauqua, Pa.	47	A	1.30	1.30	B1	.180	.180	C3	.30	.29	D	.012	.012									
C. B. Murray, Edgar Thomas S. W'ks, Braddock, Pa.	48	A3	1.26	1.26	B3	.171	.171	C	.35	.35	D	.011	.011	E	.52	.52	F7	3.56	3.56	G2	4.18	4.18
J. R. Harris, Tenn. C. I. & R. R. Co., Birmingham, Ala.	49	A	1.26	1.26	B	.183	.183	C	.34	.34	D	.012	.012							G1	4.04	4.04
E. E. Johnston	50	A	1.26	.126	B1	.178	.178	C1	.34	.34	D1	.013	.013	E	.46	.46	F2	3.687	3.687	G	4.147	4.147
AVERAGE			1.261	.1262		.1762	.1761		.34	.341		.0113	.0111		0.443	0.443		3.678	3.692		4.156	4.156

analyzed by different chemists and the mean results taken as the per cent. In obtaining the strength of a solution to be used in titrating, I take just enough drillings from the "standard" to accomplish the work. A very good way to check the accuracy of the analysis is suggested by Mr. Colby in his report; that is to send the chemist pieces of the same pig. My reasons for using a pig as a "standard" in preference to a lot of drillings, is because from results obtained, it is safe to assume that a well selected, close-grained pig is more homogeneous than a large sample of pig iron drillings.

While the results shown in this paper are based upon only one sample of pig iron, yet enough information has been obtained to demonstrate clearly the importance of a homogeneous sample. They also show the degree of accuracy that can be obtained by different chemists working on a reliable sample. Few persons outside of the chemists themselves realize the importance of a homogeneous sample, nor do they understand the difficulty in obtaining such a sample. Personally I am much interested in the adoption of uniform and practical methods among iron and steel chemists if such methods can be made to meet the needs of the time. But since iron and steel manufacturers are increasing their demands for rapid work, it would seem quite a difficult task to adopt uniform methods in all our laboratories. Many of the so-called "short methods" are quite accurate in the hands of the chemist who knows well the material he is working with while the same method would not give satisfactory results if applied generally. Uniformity is the surest means of securing for our profession the recognition which it justly deserves.

In conclusion, I cannot sufficiently thank my fellow chemists for their kind and generous response to my circular. My acknowledgments are also due to our manager, Mr. L. E. Dunham, himself a practical chemist, who has assisted me in many ways, and to the Ashland Iron & Steel Co., for printing this report. It is hoped that the showing made herein will be of some value. The sample pig used in this investigation is still in the possession of the writer, who will gladly send borings to any one interested in checking results with those in the above table.

The Harrison Safety Boiler Works, of Philadelphia, note the following late sales of their Cochrane Separators: Selvery Wychoff Co., Springfield, Mass., 4-in.; McCormick Harvesting Machine Co., Chicago, two 10-in., two 20-in. and one 14-in. vacuum oil, and one 7-in.; M. J. Daley-Waterbury, Conn. 4-in., Stewart Iron Co., Ltd., Sharon, Pa., two 10-in.; J. B. Hill & Co., 5-in. Cambridge Jail, Cambridge, Mass., two 10-in., one 8-in., and one 7-in.; King Phillip Brewery, Fall River, Mass., one each 2-in. and 4-in.; Smith-Anthony Co., Boston, 3½-in.; Cochrane Chemical Co., Boston, 4 in.; Braman, Dow & Co., Boston, 3½-in.; Dealers' Hygeia Ice Co., New York. 6 in. oil ammonia; Consumers Ice & Cold Storage Co., Erie, Pa., 10-in.; Coch, rane Chemical Co., Everett, Mass., 5-in.; National Steel Co., Youngstown, O., two 8 in., two 6-in., three 5 in., and one 12-in.; Eastern Mfg. Co., So. Brewer, Me., 8-in.; Colgate & Co., Jersey City, two 2-in.; National Tube Works, McKeesport, Pa., 4-in.; Howe & Davidson, Chicago, 4-in.; Fred. W. Wolff Co., Chicago, 5 in.; Atlas Cement Co., Northampton, Pa., 5-in. horizontal; Chicago & Wilwakuee Elec. Ry. Co., Highwood, Ill., one each 8-in., 12-in., and 16-in.; Cheney Bros, So. Manchester, Conn., 10-in.

In line with the extraordinary provision of conveniences for the use of employes as described in the paper of A. W. Walker, of the Walker & Pratt Mfg. Co., before the foundrymen at Pittsburg, is a recent move of the Midvale Steel Co. At its Nicetown plant the company is erecting seven bathhouses, 15x58 feet each, equipped with bath tubs, shower bath, etc. for the accommodation of employes.

The Edward P. Allis Co. states that the advisability of securing larger facilities has been considered and that offers have come from other cities, including Chicago, Providence, a Pennsylvania point, and a specially attractive offer from Cleveland. There is no immediate expectation of a move, but the contingency may arise. The company has on hand $4,000,000 worth of contracts.

CAUSES OF UNCERTAINTIES IN CAST IRON.*

BY PAUL KREUZPOINTNER.

The selection of the proper grade of pig iron is the foundryman's great concern and Mr. West has pointed out very clearly in his paper that one of the principal weapons with which the foundryman fights the industrial battle of to-day is antiquated and defective, inasmuch as the present method of selecting pig iron by fracture is defective and misleading.

How is the structure formed which we see on breaking a pig? A molten mass of iron in the blast furnace, cupola or ladle, is a combination of chemical elements held in solution by the fluid mass of iron as salt or sugar is held in solution by water. Each of these elements, when by itself, has a different melting point and point of cooling.

As soon as the iron gets cold enough crystals form, and these crystals try to extract out of the surrounding fluid metal all the elements which are necessary to their growth. Thus the crystals grow as long as they have an opportunity to absorb some of the substances surrounding a crystal. Hence, if we cool the iron quickly we prevent the crystals from growing any further, and they will have the size, therefore, which the crystals had when stopped from further growth, and not the size representative of any particular chemical compound, generally speaking. A couple of years ago I came across a very striking instance of the effect of time in cooling on the size of the structure of iron and steel. A large amount of the contents of an open-hearth furnace had broken through the bottom of the furnace. The bottom was repaired and the metal left where it was until the furnace had to be torn down. Here was an opportunity for the escaped metal to cool very slowly. As a consequence the crystals in that mass of soft steel were of extraordinary size. I obtained a well formed crystal which measured 1⅛ inches in length and ⅝-inch in width. I have still a piece of that metal with a crystal imbedded measuring ⅝-inch. Ordinarily the crystal of such steel in the ingot measures a few hundredths of an inch. Now, while such an instance is very rare, yet it furnishes proof of the importance and influence of time in cooling a molten mass of iron on the size of structure, irrespective of chemical composition.

You can readily imagine the gradations in size of structure, due to time cooling, between the crystal 1⅛ inches long and the fine structure we might be able to obtain in the same metal by instantaneous cooling of the mass. For the same reason an iron low in silicon may have as coarse, if not a coarser, fracture than an iron higher in silicon and graphitic carbon.

There is another property of cast iron with which the foundrymen are very much concerned, but which thus far has not received the attention it deserves. Cast iron is an alloy composed of iron and other substances. Now the melting point of alloys varies with the variation of the per cent of constituents forming an alloy. Thus, for instance, wrought iron melts at 2,912 degrees F., gray iron at 2,280 degrees F., white iron at 2,075 degrees F., an alloy of 1 tin and 25 lead melts at 558 degrees F., while an alloy of 6 tin and 1 lead melts at 381 degrees F. The melting point of tin alone is 451 degrees F., and that of lead is 618 degrees F. Naturally an increase of number of elements in an alloy and variations of percentage of these elements will produce complications in the melting points of alloys. These complications are increased by the law of affinity, according to which certain elements will attract each other and combine with one another more readily than other elements. It must be obvious that during the formation of such complications the rate of cooling plays again an important part.

But to fill the foundryman's cup of bitterness and perplexities to overflowing there is the phenomenon of segregation in alloys, and cast iron is very much bothered by this phenomenon. Iron, like water, has the ability to dissolve and hold in solution foreign substances when in a fluid state. But when a fluid mass of iron cools down to the point of solidification the foreign subtsances, held in solution while the iron was fluid, segregate out of the iron one after another, as salt segregates out of the water whenever there is more salt dis-

* Contributed to the discussion of Thos. D. West's paper on "The Deceptive Fracture of Cast Iron" at the Pittsburg meeting of the American Foundrymen's Association, May, 1899.

solved in a hot brine than the water can hold when cold. Now the iron can hold more carbon, silicon, etc., chemically combined, when in a fluid state than it can hold when in a solid state. Consequently, when a molten mass of cast iron freezes, such of the foreign substances having been held in solution by the molten iron as cannot be held chemically combined by the solidified iron will be pushed out, or segregate out, until the mixture reaches certain proportions. This mixture, having reached such proportions of elements as are peculiar to cast iron, will be the last portion in a casting to freeze or solidify. This mixture in alloys, freezing last, is called the mother metal in alloys of metals, and mother liquor in other mineral solutions, for cast iron and pig iron are nothing but mineral solutions after all.

According to Roberts-Austen and Jueptner von Jonstorff the mother metal of cast iron is composed of 95.7 per cent of iron and 4.3 per cent of carbon. The mother metal of an alloy of copper and silver contains 28 per cent of copper and 72 per cent of silver. Whenever, therefore, in an alloy an excess of elements is present over and above the proportions necessary to form the mother metal, then this excess will separate or freeze out or segregate out of the molten mass and solidify before the mother metal freezes or solidifies. This is the reason why a plumber can make a wiped joint. If he would take a mixture of lead and tin, or whatever metals he uses, of such proportions as to just form the mother metal of a tin-lead alloy he could not make a wiped joint, because his mixture would freeze or solidify under his hands so quickly that no time is left to wipe the joint. But having an excess of lead, this excess freezes first, and continues freezing while the plumber is wiping his joint, until so much of it has frozen or segregated out of the mixture as to leave the proper proportions of metals for the formation of the mother metal. When that point is reached the whole of the mixture solidifies at once and altogether without any further segregating out of the one or other of the metals.

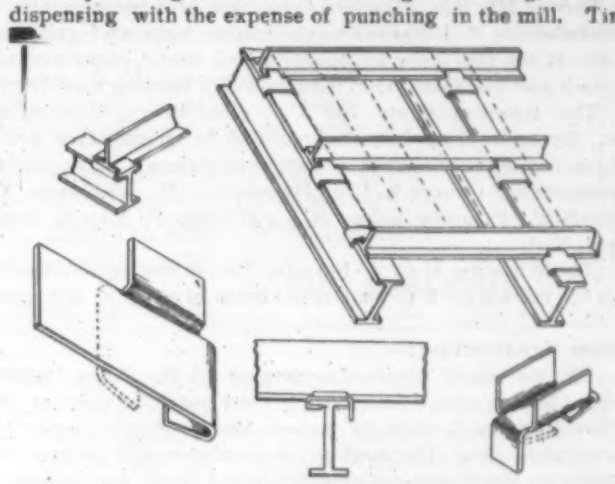
Now this same action takes place in cast iron or other alloys, and this segregating out of the excess of elements in alloys, over and above those proportions necessary to form the mother metal, or entectic alloy, as scientists call it, is a disturbing factor of unknown influence in the brass and iron foundry. On account of this cast iron has two cooling points instead of one. In other words, the excess of elements present over and above the mother metal solidify first and at a higher temperature than the mother metal. For instance, a mixture of cast iron with 98 per cent of iron and 2 per cent of carbon will solidify at 2,408 degrees. But if the iron is given a long time to cool, long enough for the segregating out of the excess of iron over and above 95.7 per cent of iron and 4.3 per cent carbon, which is the mother metal of cast iron, then that iron will solidify at two different temperatures—viz., the excess at about 2,408 degrees F., and at 2,066 degrees F., which is the cooling point of the mother metal or entectic alloy of cast iron. According to Charpy, bronzes may sometimes have three, or even four freezing points.

The practical lesson for the foundryman from all this is: if he knows he has the right mixture for a given purpose, to try and pour his iron at a sufficiently low temperature, so as to prevent segregation as much as possible in large castings. Under unfavorable circumstances such segregated castings, in spite of the fact that the chemical composition is all right, may be weak because of the want of homogeneity in the structure. The casting may appear solid enough, but where a casting happened to solidify at two different temperatures the structure or grain cannot be uniform throughout the mass, and there is liability that lines of weakness run through the casting between the juncture of patches of coarser grain and finer grain. We can also readily see that it is not always the chemical composition alone that secures a good, strong and sound casting. We can also readily imagine what possibilities there are in alloys in general, and cast iron in particular, for the formation of an endless variety of combinations and complications, due to this peculiarity of segregation in alloys of metal. And the greater the number of elements present the greater the liability for complexities.

The American Car & Foundry Co. is building a new foundry as an addition to its Wells & French plant, Chicago.

[illegible] Steel Clip.

A steel clip for connecting angle or tee bars to I beams in steel construction work has been used successfully for a number of years by prominent construction companies. The patent is that of H. A. Streeter, and the clip is manufactured at his Globe Iron Works, 35-41 Indiana st., Chicago. The device reduces the expense of connecting shapes by one half, superseding the method of drilling and bolting, and thus dispensing with the expense of punching in the mill. Time



is saved and an easy adjustment of tee bars to any desired width of tile made possible. The Keystone Bridge Co., Geo. A. Fuller & Co., and other structural working concerns have adopted the clip. Special fitting is not necessary, as is frequently the case in bolted construction for roofs where holes are not properly spaced. In steep and complicated roofs the laying out of holes by the old method is a tedious and difficult task, in making sure that the members come together exactly. A factor of some importance is that the clips can be put on rapidly by unskilled labor. The form of the clip and the method of application are shown in the accompanying cut.

The Gem Bicycle Stand.

The City Forge & Iron Works, of Dayton, O., for the past four years have made a specialty of their Gem bicycle stands. Sales have aggregated about 25,000, shipments being made to all parts of the United States and to England, Germany France, and India. The stand is of steel, strong and substantial, and of attractive design. A space 18x24 inches is provided for advertising card. The bottom spread is 24x24

inches, the height 50 inches, weight 28 pounds. Orders have been shipped recently to the Lozier Mfg. Co., Toledo; H. J. Hersey Cycle Co., Indianapolis; Banker Bros. Cycle Co., Pittsburg; Lipman Bros., Savannah; Charles F. Young, York, Pa.; Western Union Telegraph Co.; Postal Telegraph Co.; H. Whitman & Co., Lincoln, Neb.; and others. Prices and descriptive matter are sent upon application.

The Lodi Mfg. Co., Lodi, O., has been incorporated with a capital of $50,000. A large line of hardware specialties will be manufactured, the inventions of E. D. Berry, formerly of the Zenith Mfg. Co., Cleveland. Mr. Berry is president, and A. B. Taylor, of Lodi, treasurer of the new company. A two-story brick factory is being erected, which will be completed in 90 days.

INDUSTRIAL SUMMARY.

[I you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Jacoby Foundry & Machine Co., of Moberly, Mo., has been incorporated, with a capital stock of $20,000, by F. C. Jacoby, W. W. Jacoby and H. G. Crake.

Farmer Mfg. Co., Hartford Conn., has been incorporated to manufacture A. J. Farmer's combination lathe and grinding tool. It will also make a specialty of tool, model, experimental, punch and die, sheet metal work and wire bending machinery.

The National Grate Bar Co., office at 239 Washington st., Jersey City, has been incorporated to manufacture grate bars, fire brick, etc., with a capital of $250,000 The incorporators are George S. Lee, Hawthorne, N. J.; George V. Sheffield, Pompton Lakes, N. J.; William P. Martin, Newark, N. J.

The Wheeling Mold & Foundry Co., Wheeling, W. Va., is in the market for a 10-ton electric crane of about 38 feet span.

New Construction:—

The Bureau of Steam Engineering of the Navy Department has completed plans for the new machine shop at the New York navy yard, to replace the building recently destroyed by fire. The machine shop proper will occupy the space on Morris ave. between Fifth and Sixth sts., having a frontage on the avenue of 350x130 feet, and will extend in the form of an L along Sixth st., for a distance of 470 feet, the rear portion being designed for an erecting shop. The area of the buildings will be about 80,000 square feet. The power house is the only separate structure. Advertisements will be issued in a few weeks for the work of construction. The contract may include equipment also.

An addition is being constructed to the molding department of the Troy Malleable Iron Works, at Watervliet, N. Y., to complete the original plan as adopted in 1892. The new wing is 375x75 feet.

The Shiffler Bridge Co., Pittsburg, is building an extension to the plant of the Landis Tool Works, Waynesboro, Pa.

At Bay City, Mich., the Bay City Boiler Co.'s plant is going up. The main building is 50x100. Machinery has been ordered.

A new machine shop 40x80 feet is in course of erection at the Dietrick & Hervey Co.'s plant at Baltimore.

For the Olds Motor Co.'s plant at Detroit. Mich., plans include a machine shop 70x300 feet, two stories; foundry, 70x140 feet, one and two stories; storage house and offices, 50x179 feet, two stories; blacksmith shop, 31x100.

C. A. Stickney, St. Paul, Minn., has completed plans for the building of a factory for making gasoline engines. The building will be of brick, 50x150 feet, and two stories, costing about $10,000. The gasoline engines to be manufactured are of a new pattern designed by Mr. Stickney. Operations will begin Sept. 1.

The Camden, N. J., city council, has granted the New York Shipbuilding Co. a concession of 100 acres of land in South Camden. The company intends to erect several buildings, the largest of which is to be 1,400 feet long. It will also build four drydocks, one of which will be capable of holding the largest vessel in the United States navy. The company will be capitalized at $3,000,000.

Power Equipment and Machine Tools:—

It is reported in connection with the recent order of the Grand Central Railway, of England, to the Baldwin Locomotive Works, for 20 freight engines, that the English demand for American locomotives was purely a matter of speedy delivery. The engines are to be of the same pattern and design as those constructed for the Midland Railway, making a total of 40 of these American engines for use on English railways. About 2,500 men are employed in the Baldwin shops, and three completed engines are being turned out every day.

For the two new modern furnaces to be built at Mingo Junction, O., and for the additional blowing capacity required at the Shenango Valley furnaces at New Castle, Pa., the National Steel Co. has contracted for $300,000 worth of new blowing engines. The acquisition of the Ohio Iron Co.'s furnace at Zanesville, O., by the National Steel Co. represents a saving on a year's output of from $350,000 to $400,000, at current prices of Bessemer pig iron.

Cincinnati papers state that the Niles Tool Works Co., which for two years has had the Pond Machine Tool Co. as an identified interest, is negotiating for a consolidation of these two interests with Bement, Miles & Co., of Philadelphia, the new organization to have a capital of $6,000,000, equally divided between preferred and common. The capital of the Niles Tool Works Co. is $2,000,000 and that of the Pond Machine Tool Co. $500,000. The Niles Tool Works Co. informs us that the statements recently appearing in the newspapers about a proposed merger, as above, are without foundation and unwarranted.

The Powell Planer Co., organized under the laws of the State of Massachusetts, and located in Worcester, has changed its name, by the authority of the commissioner of corporations, and adopted the name of Woodward & Powell Planer Co. This corporation is under the same management to-day that existed when it was first incorporated in 1887.

The Tubular Despatch Co., owning and operating the pneumatic mail transmission tubes in New York City, has placed an order for three duplex Corliss air compressors with the Pneumatic Supply & Equipment Co., of New York, recently organized to install complete compressed air plants. These compressors are to be located in the sub-basement of the Metropolitan Life Insurance Building, New York. The capacity of each is in excess of 1,300 cubic feet of free air per minute, and the entire cost of the installation is understood to be over $12,000.

The Pittsburg District:—

Two trains of 50 steel freight cars each left Pittsburg last week for the seaboard, where they will make a shipload to be taken to Alexandria, Egypt, for the Egyptian Railway Co. The weight of the consignment is about 2,000 tons, and the contract price a trifle over $100,000.

The National Tube Works Co., of McKeesport, Pa., has advanced wages of puddlers from $4 to $4 25 a ton. The mill is non-union, but wages have been based on the Amalgamated scale.

A plant for the manufacture of seamless drawn tubing will be erected at Ellwood City, Pa. Interested in the project are John Nicholson, formerly of the Shelby Steel Tube Co., H. W. Hartman, who has been prominently identified with the founding and growth of Ellwood City, J. H. Baker, and C. E. Pope, of Chas. E. Pope & Co., iron and steel factors of Pittsburg The Shiffler Bridge Co., has the contract for two buildings, each 105x300 feet. C. H. Bradley, Jr., & Co., Pittsburg representatives of the Nordberg Mfg. Co., Milwaukee, has the contracts for the two engines, and the Clearfield Fire Brick Co. has the contract for the brick.

Jones & Laughlins, Ltd., will start the plate mill at the old Moorhead & McCleane plant, which has not been in operation since 1896.

The Pittsburg Reduction Co. has received an order from the Chicago Northwestern Elevated Railway Co. for 150,000 pounds of aluminum to be used for feed wires.

D. Lamond, of Pittsburg, has been awarded the contract for the building of another stove at the blast furnace of the Penn Iron & Coal Co., Canal Dover, O.

Phillips-Nimick & Co., of Pittsburg, are overhauling their plate mill, and will resume as soon as repairs are completed.

The American Steel & Wire Co. has purchased all the stock of the Shoenberger Horseshoe Co., Pittsburg, recently formed to make and export horseshoes. The proposed plant at Glassport will be abandoned, and the property purchased will probably be sold. The output of the Shoenberger horseshoe plant of the American Steel & Wire Co. in Pittsburg will be increased to almost 1,000,000 kegs of horseshoes a year.

General Industrial Notes:—

Charles H. Besly & Co., 10 and 12 N. Canal st., Chicago, Ill., report that as western representatives they carry a complete stock of the Pecora machinery paints, which have been on the market since 1862. Flat steel color is in paste form for engines, tools and general machinery. Egg shell gloss enamel is a finishing paint for engines, tools and general

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Do you want a Heater, or an Oil Separator, or a Steam Separator? Kindly state the conditions and the requirements, and we will immediately place at your service what we know about, and what we have to offer in these lines.

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machinery. It is dust proof in 10 minutes and dries hard in 30 minutes. It is sold only in liquid form. Dresden machine enamel imparts a glossy appearance for radiators, gas engines, etc. Iron filler is for making rough castings smooth. Pecora blow hole cement will stand under the planer, lathe, file and other finishing operations. It comes dry and is worked with a knife. It stands 200 degrees of heat and is gas and air tight. C. H. Besly & Co.'s new May, 1899, catalogue now ready for distribution. It is mailed free to any address on application.

James Smith located at 75 Elm st., Cincinnati, makes a specialty of handling second hand iron and wood-working machinery, thoroughly rebuilding all tools in his shop before offering them for sale. His facilities and connections are such that his stock for ready shipment comprises a variety of tools of standard makes. At present, the list includes nine lathes, varying from 14x5 to 30x15; three drill presses 10-20-30 inch, one milling machine, and a small planer. In wood-working tools there are one 8-inch sticker, two carving machines, cut-off saw, universal wood worker, three tenon machines, mortiser and two boring machines. Description and prices will be sent on application.

The Central Iron & Steel Co., at Harrisburg, has started its Herr st. muck bar mill, idle for many months.

A contract for 10,000 tons of 65-pound steel rails has been let to the Colorado Fuel & Iron Co. by the Pacific & Idaho Northern Railway Co., which is now building into the Seven Devils copper region from Weiser, Idaho.

At a recent meeting of the Tidewater Steel Co., Philadelphia, the board of directors was elected consisting of Geo. H. Stickney, Evans R. Dick, Chas. A. Porter, R. H. Rushten, R. A. Williams, Jr., Isaac N. Solis, F. W. Wood, Geo. S. Graham and Geo. McCall.

The rail mill of the Illinois Steel Co., at South Chicago, has broken the world's record in a 12-hour run. The new record is 1,310 tons. The previous record, held by the same mill, was 1,301 tons.

The Lackawanna Iron & Steel Co. is working on an order of 7,000 tons for the New York, Wyoming & Western R. R.

The entire plant of the New Castle Engineering Works, formerly the J. P. Witheron Co., will be sold at public auction at the court house in New Castle, Pa., on Monday, June 5. It is a thoroughly equipped engineering and construction plant in good order and ready for immediate operation.

The Interstate Malleable Iron Works at West Duluth, Minn., have been closed temporarily owing to a disagreement among stockholders. The works have good contracts and have done well. More capital is needed. It is expected that operations will be resumed and on a larger scale.

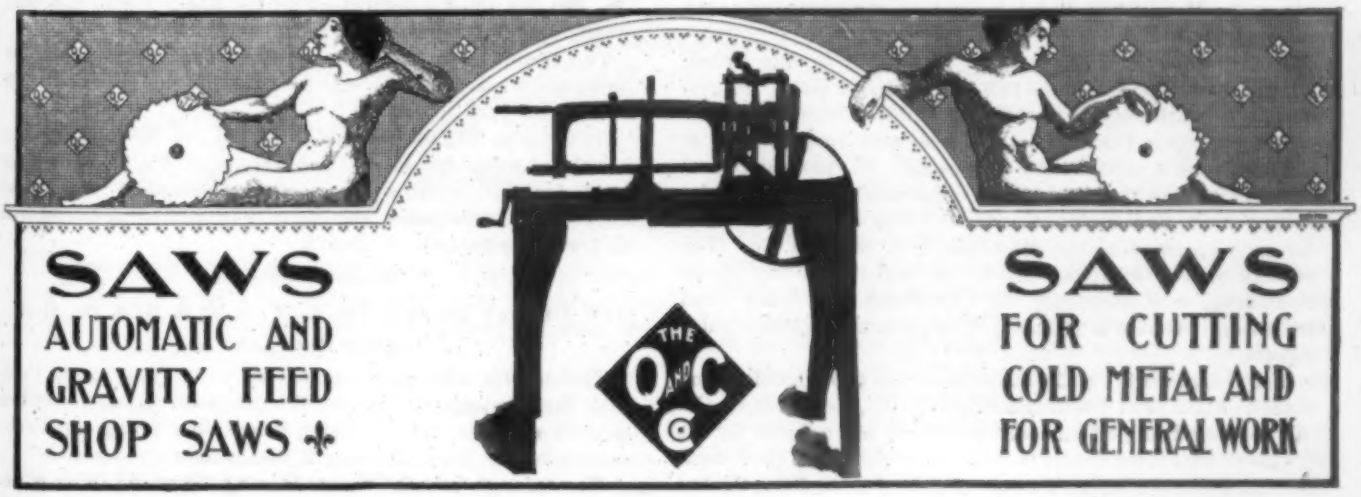
At the annual meeting of the Cramp Ship & Engine Building Co., Philadelphia, the directors were re-elected with the exception that Edwin S. Cramp was elected a director in place of Mr. Seligman. The total net profits for the year ending April 30, 1899, were $707,832, an increase of $133,991 over 1898.

It is reported that the Standard Wheel Co.'s plant at Ft. Wayne, Ind., has been sold to John H. Bass, for $40,000. The wheel company have not operated the Ft. Wayne factory for several years, and Mr. Bass bought the property that he might enlarge his foundry and machine shop.

It is stated that some New Castle parties, including Wm. Bonatef and C. W. Watson, are negotiating for a lease of the plant of the Greensburg Steel Co., Greensburg, Pa., long idle.

The Bradford Lathe Co., Cincinnati, since January 1 has installed $10,000 worth of new machine tools in its plant, especially adapted for the production of the Bradford lathe.

Jones & Laughlins, Ltd., Pittsburg, are having plans prepared for the remodeling of their Bessemer department. It is the intention to add two 12-ton converters. Arrangements will be made also for taking direct metal from the furnaces



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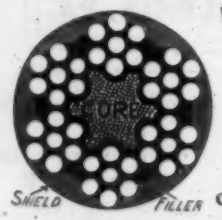

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across the Monogahela River, by way of the company's own railroad and bridge.

The Scottdale Iron & Steel Co. is putting in five Cahall water tube boilers, each of 250 h. p. The horizontal boilers, except one battery, now at the plant will be abandoned.

The Champion Iron & Steel Co has been incorporated at Chicago, with a capital stock of $400,000. It has purchased and will operate the open-hearth steel works and mills for rolling iron and steel, located at Muskegon, Mich., and formerly operated by the Michigan Iron & Steel Co. The officers of the company are D. M. Hillis, president; Jesse Spaulding, vice-president; L. Friedman, secretary and treasurer. Hibbert & Hibbert, Chicago, are the general sales agents.

The Duquesne Forge Co. has ordered one 5-ton double frame steel hammer form the Chambersburg, Pa., Engineering Co. An 800-pound single frame steam hammer was ordered for the Pennsylvania Railroad Co.'s shops at Allegheny. The Chambersburg Co. is erecting a 1,000-ton press for the Riter-Conley Co., and has under construction for the Baker Forge Co. two steam hammers and one drop steam hammer.

The Thomas Iron Co. has notified holders of its 5 per cent mortgage bonds that they will be paid off and interest will cease after June 1, 1899.

At Decatur, Ill., the Sattley Plow Co., of Springfield, Ill., has closed a deal for one of the buildings of the Decatur Malleable Iron Co., which will be used as a foundry. About 100 men will be employed. The capacity of annealing ovens will be greatly increased.

New Through Service Via C. T. & V. & B. & O. R. R.

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Through train from Cleveland 3:25 p. m., daily, with Pullman buffet sleeping cars to Washington, Baltimore, Philapelphia and New York, carrying Royal Blue dining car Washington to New York, arriving at that point 12:35 noon.

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During the past two seasons low rate excursions over this direct through route to the ocean carried many happy people from points in Indiana and Ohio to ten of the most attractive seaside resorts on the Atlantic coast, viz.: Atlantic City, Cape May, Anglesea, Avalon, Holly Beach, Ocean City, Sea Isle City, Wildwood, New Jersey, Rehoboth, Del., and Ocean City, Md.

The excursions for the summer of 1899 will again afford opportunity to enjoy refreshing ocean bathing and sailing, the invigorating sea air, and the myriads of attractions for which the seaside is famous.

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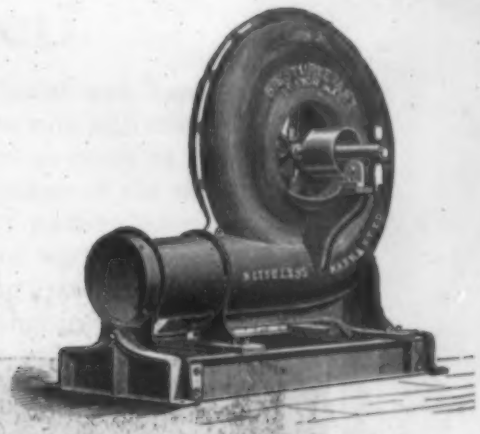

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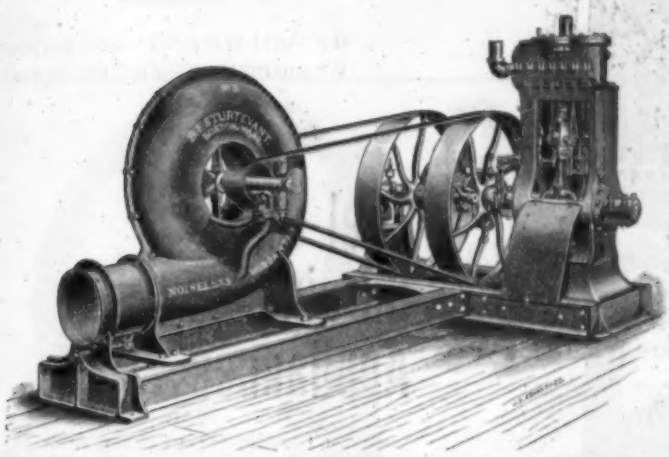

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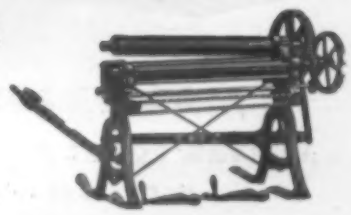

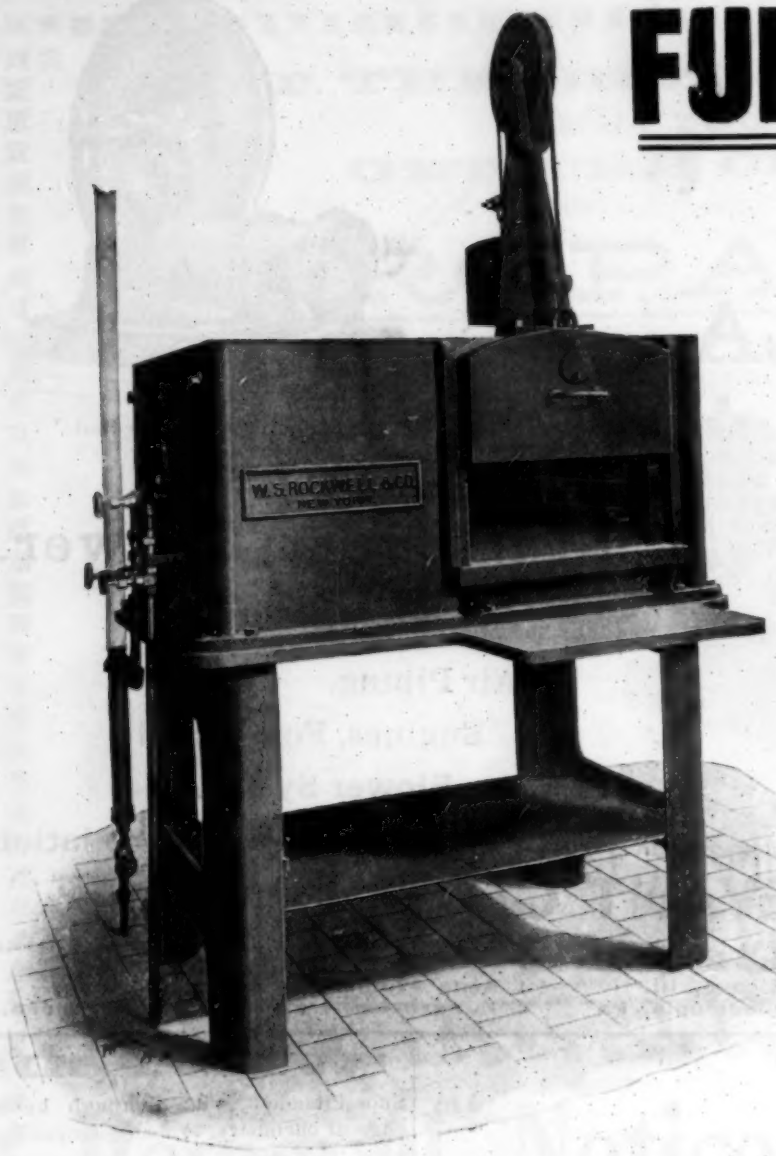

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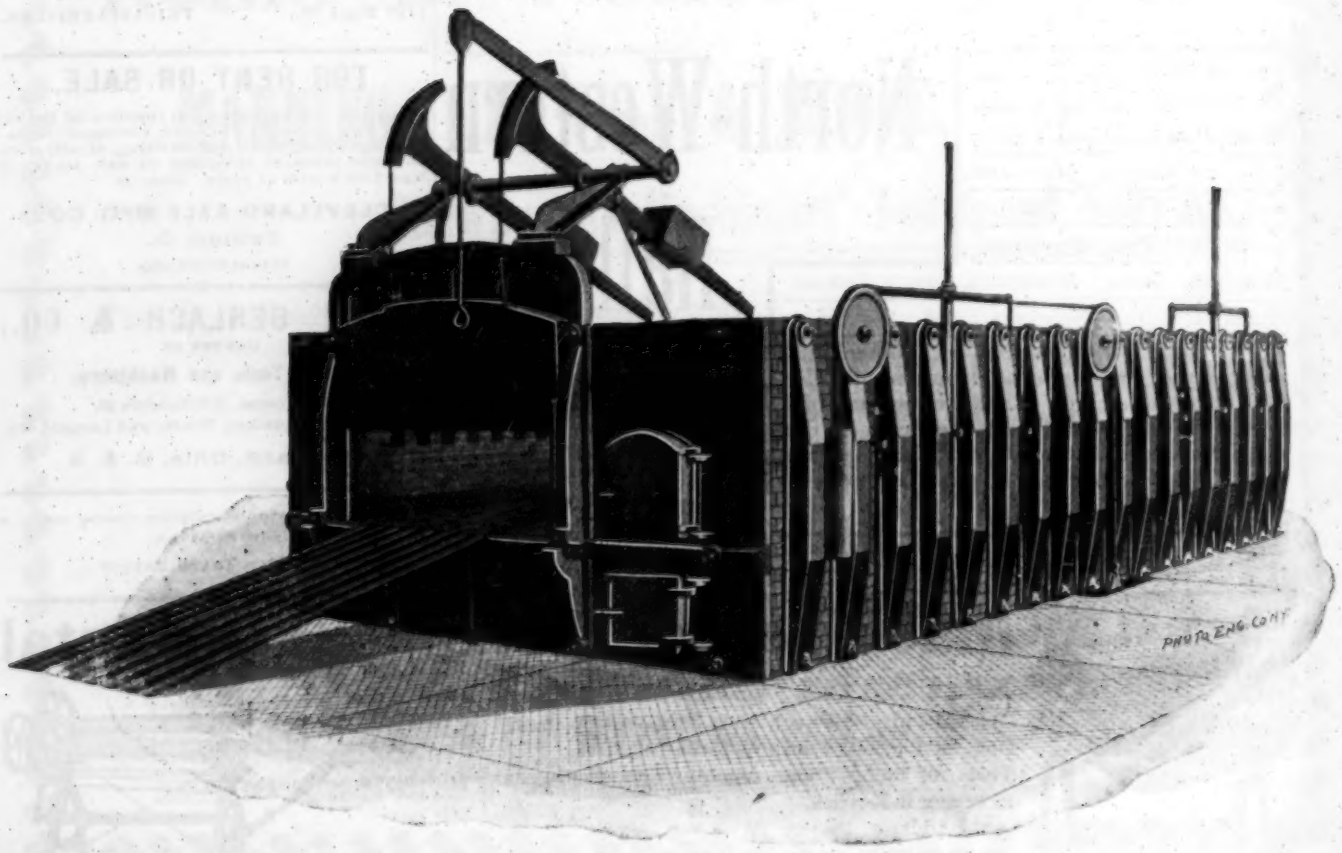

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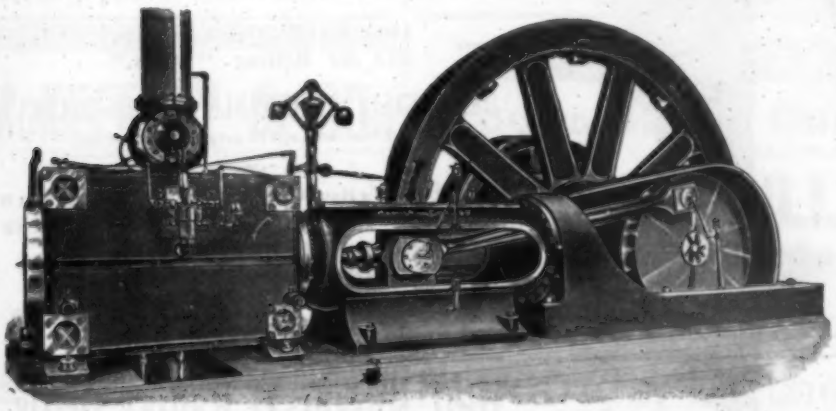

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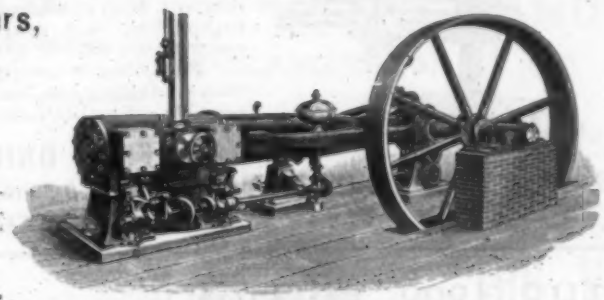

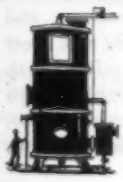

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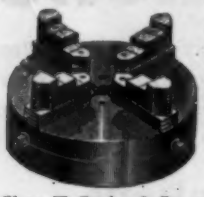

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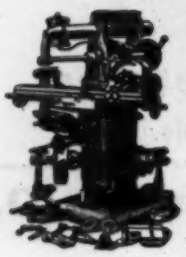

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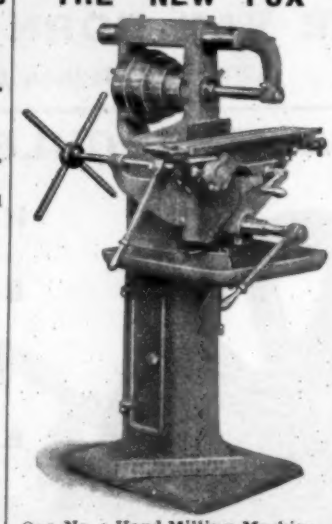

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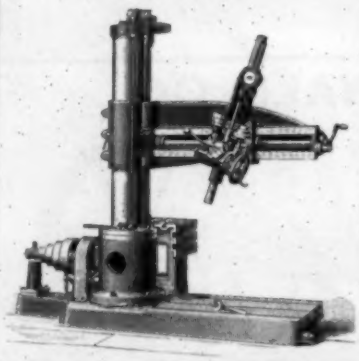

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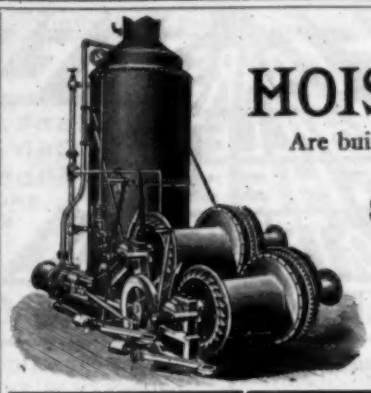

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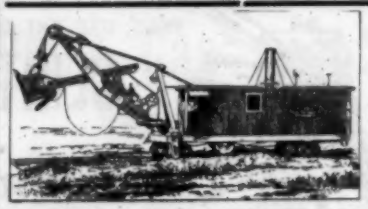

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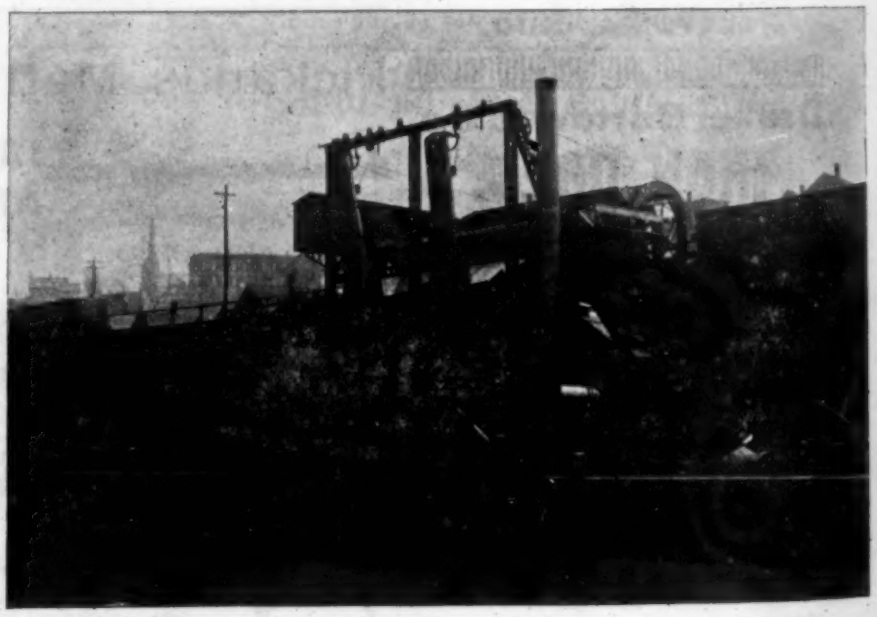

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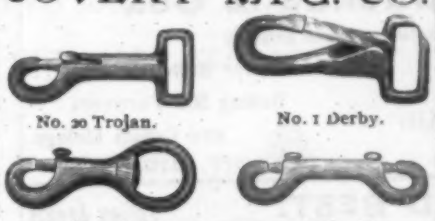

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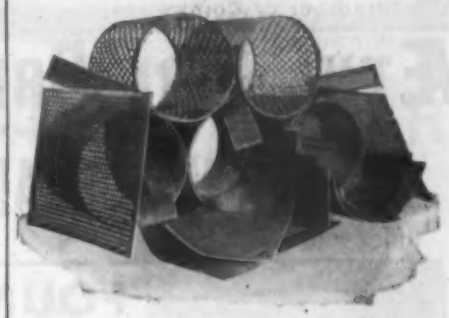

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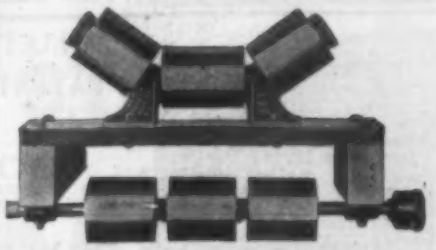

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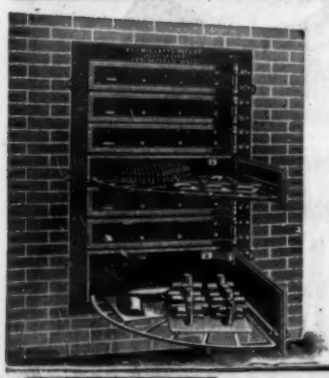

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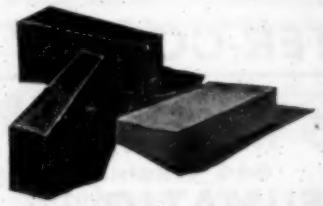

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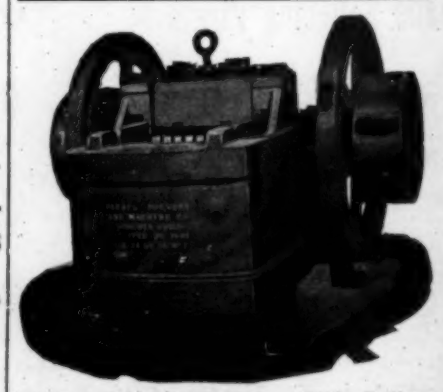

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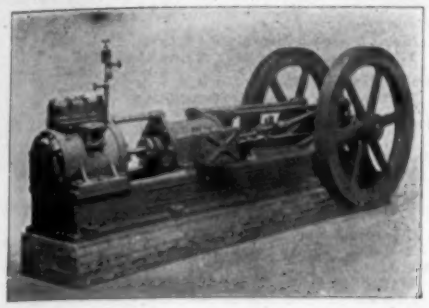

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Geo. B. Sennett Co., Youngstown, Ohio.
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Webster Camp & Lane Machine Co., Akron, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland, Pa.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati, O
Chicago Fire Clay Product Co. Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Flue Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.

Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.

Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland, O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Bræburn Steel Co., Bræburn, Pa.
Wyman & Gordon, Worchester, Mass.

Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Furnaces—
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City
American Gas Furnace Co., New York City.

Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.

Gas Burners—
American Gas Furnace Co., New York City.

Gas Furnaces—
American Gas Furnace Co., New York City.

Gauge Cocks—
James Bonar & Co., Pittsburg, Pa.

Gearing.
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.

Gear Lubricants—
The Ironsides Company, Columbus, O.

Grease—
A. F. Boettcher, Rowlands, Pa.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.

Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.

Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O
Brass Founders' Supply Co., Newark, N. J.

Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

Hangers—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.

Hoists—
Edwin Harrington Son & Co., Philadelphia,
Reading Crane & Hoist Works, Reading, Pa
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.

Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co. Chicago, Ill
Parkhurst & Wilkinson Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co. Cincinnati, O.
Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Machine Co., New York City.

Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.

Hotels—
United States Hotel Co., Cleveland, O.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Impulse Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Injectors—
C. H. Besly & Co., Chicago, Ill
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron Buildings—
Shiffler Bridge Co., Pittsburg Pa.
Riter-Conley Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O

Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davies Machine Co., Rochester, N. Y.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

Ladles—
The S. Obermayer Co., Cincinnati, O.

Lathes
W. P. Davies Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning Maxwell & Moore, New York City.

Lubricators—
A. F. Boettcher, Rowlands, Pa.

Machinery Name Plates—
August Becker, Boston, Mass.

Machinists' Tools and Supplies—
W. P. Davies Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co. Cambridge City, Ind
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Machine Screws—
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co. Cincinnati, O.
H. A. Streeter, Chicago, Ill.

Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Malleable Castings—
Acme Malleable Iron Works, Buffalo, N. Y.

Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.

Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.

Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills
F. R. Phillips' Sons Co., Philadelphia, Pa.

Milling Machines
W. P. Davies Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich
Brainard Milling Machine Co., Hyde Park, Mass.
Danielson Machine & Tool Co., Cleveland O.
Manning, Maxwell & Moore, NewYrok City.

Mining Machinery—
C. H. Besly & Co, Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Mine Pumps—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.

Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Molders' Tools—
The S. Obermayer Co., Cincinnati, O.

Name Plates—
August Becker, Boston, Mass.

Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.

Nuts and Bolts
Upson Nut Co., Cleveland, O.
Oilless Bearings—
C. H. Besly & Co., Chicago, Ill.
Oil Burners—
W. S. Rockwell & Co., New York City
American Gas Furnace Co., New York City.
Oil Cups—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Oil Filters—
James Bonar & Co., Pittsburg, Pa.
Oil Pumps—
C. H. Besly & Co., Chicago, Ill.
Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York City.
The Shearer-Peters Paint Co., Cincinnati, O.
Pattern Works—
Gobeille Pattern Co., Cleveland, O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Hickman & Williams, Chicago, Ill.
Spearman Iron Co., Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Pipe Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
W. P. Davies Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co Milwaukee, Wis
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Punches—
R. Konigslow & Bro. Cleveland, O.
Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Rivets—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.
Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.
Saws—
Peter Gerlach & Co., Cleveland, O.
Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Screw Machines—
Cleveland Ball & Screw Co., Cleveland, O.
Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.
Shafting—
The Lane & Bodley Co., Cincinnati, O.
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Shapers—
W. P. Davies Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
Fox Machine Co., Grand Rapids, Mich.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Danielson Machine & Tool Co., Cleveland, O.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
R. H. Stroud & Co., Chicago, Ill.
Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.
Special Machinery—
Edwin Harrington Son & Co., Philadelphia
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
R. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.
Steam Packing—
C. H. Besly & Co., Chicago, Ill.
Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Steam Separators—
James Bonar & Co., Pittsburg, Pa.
Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Steam Specialties—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Steel—
Otis Steel Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Steel Balls—
Cleveland Ball & Screw Co., Cleveland, O.
Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.
Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.
Steel Tubes—
Shelby Steel Tube Co., Cleveland, O.
Stokers—
Playford Stoker Co., Cleveland, O.
Tanks—
Enterprise Boiler Co., Youngstown, O
Meehan Boiler & Construction Co., Lowellville Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Tank Cars—
The Wm. B. Pollock Co., Youngstown, O
Tin and Terne Plates—
R. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.
Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Tool Steel—
C. H. Besly & Co., Chicago Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O
Dodge Mfg. Co. Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Tubes—
National Tube Works McKeesport, Pa.
Shelby Steel Tube Co., Cleveland, O.
Tube Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Tube Welding—
S. Fix Sons, Cleveland, O.
Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.
Twist Drills—
C. H. Besly & Co., Chicago, Ill.
Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.
Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.
Ventilating Fans—
B. F. Sturtevant Co., Boston Mass.
Vises—
Massey Vise Co., Chicago, Ill.
Wa er softening Plant—
We Fu Go Co., Cincinnati, O.
Wire Coating.
The Ironsides Company, Columbus, O.
Wire Filler.
The Ironsides Company, Columbus, O.
Wire Machinery—
The F. B. Shuster Co., New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.
Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.
Wire Rope Coating.
The Ironsides Company, Columbus, O.
Wire Rope Filling.
The Ironsides Company, Columbus, O.
Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.
Wrought Pipe—
National Tube Works, McKeesport, Pa.

Alphabetical List of Advertisers.

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Hunt Robt. W., & Co. 2
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United States Hotel Co. 40
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Webster Fire Brick Co. 1
We Fu Go Co. 31
Wheeling Mold & Foundry Co. 44
White, Byron H. 37
Wyman & Gordon 43

BRÆBURN STEEL COMPANY, Bræburn, Pa.

MANUFACTURERS OF

FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, P. B. Hasbrouck, E. F. Kelly, Sec'y. and Treas.

MORE WEAR from your tools

.....Almost no **STEEL EXPENSE**

NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.

Cleveland Warehouse, 97 Water St.

La BELLE STEEL CO., Pittsburgh, Pa.

MANUFACTURERS OF FINE

CRUCIBLE CAST TOOL STEEL.

SPECIAL GRADES FOR ALL PURPOSES.

BYRON H. WHITE,

Western Selling Agent.

OFFICE AND WAREHOUSE: **68 and 70 South Canal St., Chicago.**

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THE MORRIS & BAILEY STEEL CO.
COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING DRAWING BLANKING SPRINGS ETC
PITTSBURG, PA.
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Don't Waste Money in Your Pattern Shop.

THE GOBEILLE PATTERN CO., Cleveland.

OUR NEW

University Bicycle Saddle

WILL SOON BE READY.
LOOK FOR IT.

Parkhurst & Wilkinson Co.,

146-164 Kinzie Street, CHICAGO.

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All standard and special grades.
In sectional molds or bars.

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Wrtte us for prices always. It will pay you.

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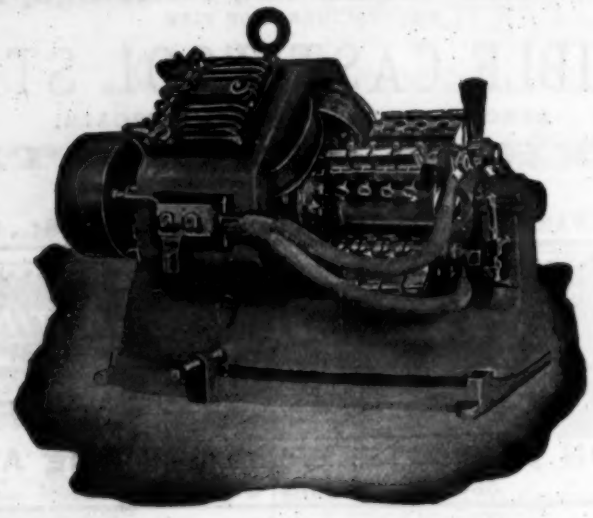
— FOR —

BICYCLE PLATING PLANTS.



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EXCLUSIVE WESTERN SELLING AGENTS.

Leviathan Belting.

Tested under the hardest possible conditions and proved by years of service to be the best belt

For Heavy Driving of All Kinds.

Proof against Heat, Steam and Water.

Strength, Durability, and Traction Power Unequalled.

SOLE MANUFACTURERS,

MAIN BELTING CO.

1219-1235 CARPENTER ST., PHILADELPHIA.
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120 PEARL ST., BOSTON.

Send for Price Lists and Samples.

RAWHIDE BELTING

And Lace Leather.

— ALSO —

Rawhide Rope, Pinions, Picker Leather, Halters, Bell and Register Cord, and other Rawhide Goods of all kinds.

THE MABBS HYDRAULIC RAWHIDE PACKING.

CHICAGO RAWHIDE MFG. CO., 75-77 Ohio St., CHICAGO, ILL.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

IRON AND STEEL MARKETS.

IRON ORE.

(On Lake Erie docks.)

Special low-phosphorus hard Ore, Bessemer	$3.75
No. 1 Specular, Bessemer	$3.15@3.50
No. 1 Bessemer hematite	2.75@3.25
Hematites No. 1 non-Bessemer	1.90@2.10
No 1. Specular, non-Bessemer	2.00@2.40
Mesabi Bessemer	1.80@2.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$16 65
No. 1 Strong Foundry	$16 75@17 00
No. 2 Strong Foundry	16 15@16 65
Gray Forge, red short	15 25@15 50
Gray Forge, neutral	15 75
No. 1 American Scotch	16 75@17 00
No. 2 American Scotch	15 15@16 65
Lake Superior Charcoal	17 00@18 00
PITTSBURG:	
No. 1 Foundry	$16 25@16 75
No. 2 Foundry	15 75@16 00
Gray Forge	14 75@15 00
Warm Blast Charcoal	18 00@19 00
Cold Blast Charcoal	21 00@26 00
Bessemer	17 00@17 50
CHICAGO:	
Lake Superior Charcoal	$17 00@$18 00
Local Coke Foundry No. 1	15 50@15 75
Local Coke Foundry No. 2	15 00@15 50
Local Coke Foundry No. 3	14 50@14 75
Local Scotch Foundry No. 1	15 50@15 75
Local Scotch Foundry No. 2	15 00@15 50
Local Scotch Foundry No. 3	14 50@14 75
Southern Coke No. 1	16 00@16 25
Southern Coke No. 2	15 25@15 75
Southern Coke No. 3	14 75@15 00
Southern No. 1 Soft	15 50@16 00
Southern No. 2 Soft	15 00@15 50
Southern Silveries	15 50@16 00
Jackson Co. Silveries	17 00@18 00
Ohio Silveries No. 1	@
Ohio Strong Softeners	15 50@16 50
Alabama Car Wheel	17 50@18 00
Malleable Bessemer	15 50@16 00
Coke Bessemer	15 50@16 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$14 75@15 25
Southern Coke No. 2 and No. 1 Soft	14 25@14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@18 00
Tennessee Charcoal No 1	15 00@16 00
Jackson County Silvery No 1	16 00@16 25
Southern Coke, Gray Forge	12 75@13 00
" " Mottled	12 75@13 00
Standard Georgia Car Wheel	15 50@16 00
Lake Superior " "	15 50@16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 60
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	4 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 50
Southern Gray Forge	13 00
Tennessee Charcoal No 1	13 75
Jackson County 2 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@16 00
Southern Car Wheel	15 25@16 25
Genuine Connellsville Coke	4 15
West Virginia Coke	4 10

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 00
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.60c
Angles	1.65c
Tees	1.65c
Universal Plates	2.00@2.25c
Sheared Plates	2.25c

MERCHANT IRON AND STEEL.

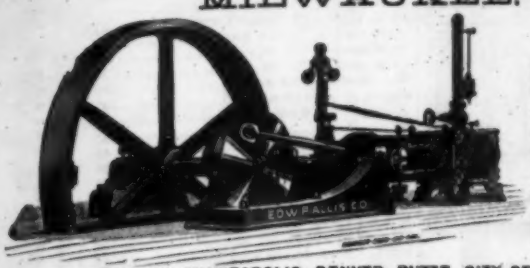
[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1½	1.80 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4¾	1.00 "
4½ to 5	1.30 "
5½ to 6	1.50 "
5¾ to 6¾	2.00 "

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

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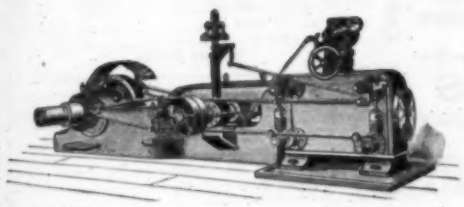
Southwark Foundry & Machine Co.

PHILADELPHIA, PA.

Porter-Allen Automatic Engines,
Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

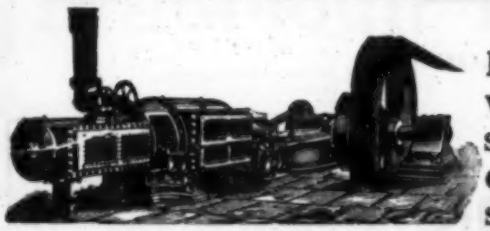
Shafting, Hangers, Pullevs.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

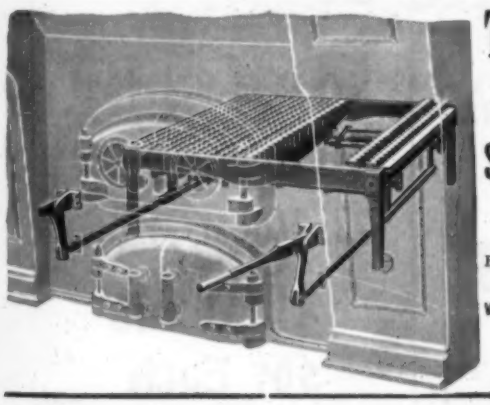
The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.

SEWARD S. BABBITT.



The Geo. B. Sennett Co.,

YOUNGSTOWN, OHIO.

Manufacturers of the

SENNETT ROCKING GRATE.

Economy of Fuel.
Economy of Time.

Prevents large clinkers. Convenient and Substantial. Apply for circulars.

We make also SENNETT ENGINE, 20 to 40 H. P
SENNETT COMPRESSION COUPLING
and CASTINGS to 5 tons each.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

6⅝ to 7¼	2.50 extra
¼ to ⅜	.10 "
⅜ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to 7 -32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1⅛ to 4 x ⅜ to 1	1.05 Base
4⅛ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1⅜ o 4 x 1 1-16 to 1½	.30 "
4⅛ to 6 x 1 1-16 to 1½	.40 "
6⅛ to 8 x 1 1-16 to 1½	.60 "
8⅛ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅜ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ⅝	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
½ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¼ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. Bevel Edge Shaft Iron 2-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¼ x No. 9 to 3-16	.70 "
6¼ to 6¼ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅝ to 1¼	.40 extra
½ to 13-16	.50 "
⅜ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
⅜ to 11-16 x ⅜	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅝ to 2	.50 "
½ to 13-16	.70 "
⅜ to 11-16	.90 "
½ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

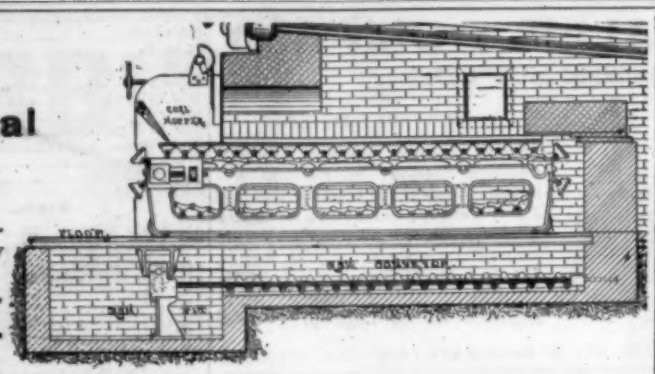
Steel Bands.

Width In Inches.	English Standard Gauge.		
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base. Extras.	
1⅜ to 6,	" 10, 11, 12 or ¼"	.05 per 100 lbs.	
1 to 1⅜,	" 7, 8, 9 or 3-16"	.10	"
1 to 1⅜,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-19	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ¼"	1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base Extras.	
7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs	
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1⅜,	" 22	.25	"
⅜ to 1⅜,	" 13, 14 and 15	.05	"
⅜ to 1⅜,	" 16, 17 and 18	.10	"

The Playford Mechanical Stoker



Guaranteed to Abolish smoke, to increase boiler capacity and to save fuel.

For information, address,

The Playford Stoker Co.
404 Telephone Bldg.,
CLEVELAND, OHIO.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

COMPARE WEIGHTS

WHEN YOU ARE TOLD THAT JENKINS '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight, ⅛" "Jenkins '96." 11 lbs. to the square yard.
" " ⅛" Red Packing, 14 " " " " "
At 50c. per pound "JENKINS '96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS., New York, Boston, Philadelphia, Chicago

DIXON'S SILICA GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

FOR GREAT TENSILE STRENGTH, ELASTICITY AND ELONGATION, COUPLED WITH UNUSUAL NON-CORROSIVE QUALITIES,

Castings and Propeller Wheels

MADE FROM

PARSONS MANGANESE BRONZE

CANNOT BE EXCELLED. WRITE FOR PARTICULARS.

SOLE MAKERS,

THE WILLIAM CRAMP & SONS

Ship and Engine Building Company,

PHILADELPHIA, PA.

A paper that is paid for and read—THE IRON TRADE REVIEW.

			per 100 lbs.
1¼ to 1¾,	"	19 and 20	
1¼ to 1¾,	"	21	.20 "
1¼ to 1¾,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos. 13, 14 and 15		.20 "
⅞,	" 16, 17 and 18		.25 "
⅞,	" 19 and 20		.30 "
⅞,	" 21		.35 "
⅞,	" 22		.45 "
¾ and 13-16	Nos. 13, 14 and 15		.30 "
¾ and 13-16	" 16, 17 and 18		.35 "
¾ and 13-16	" 19 and 20		.40 "
¾ and 13-16	" 21		.45 "
¾ and 13-16	" 22		.50 "
¾ and 13-16	" 23		.60 "
11-16,	Nos. 13, 14 and 15		.35 "
11-16,	" 16, 17 and 18		.40 "
11-16,	" 19 and 20		.50 "
11-16,	" 21		.60 "
11-16,	" 22		.70 "
11-16,	" 23		.80 "
⅝,	Nos. 13, 14 and 15		.40 "
⅝,	" 16, 17 and 18		.45 "
⅝,	" 19 and 20		.55 "
⅝,	" 21		.65 "
⅝,	" 22		.75 "
⅝,	" 23		.85 "
9-16,	" 13, 14 and 15		.45 "
9-16,	" 16, 17 and 18		.50
9-16,	" 19 and 20		.60
9-16,	" 21		.70
9-16,	" 22		.80
9-16,	" 23		.90
½,	" 13, 14 and 15		.55
½,	" 16, 17 and 18		.60
½,	" 19 and 20		.70
½,	" 21		.80
½,	" 22		.90 "
½,	" 23		1.00 "
7-16,	" 13, 14 and 15		.80 "
7-16,	" 16, 17 and 18		.90 "
7-16,	" 19 and 20		1.00 "
⅜,	" 13, 14 and 15		1.00 "
⅜,	" 16, 17 and 18		1.10 "
⅜,	" 19 and 20		1.20 "

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No. 10	2 25
No. 12	2 25
No. 14	2 30
No. 15-17	2 40
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Akron, Canton & Chicago.....	*8:05 A M	*10:00 P M
Akron, Canton & Wheeling...	*10:20 A M	*3:30 P M
Akron, Canton & Chicago. ...	*8:05 A M	*6:35 P M
Akron, Canton & Marietta,...	†2:10 P M	†11:00 A M
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South Bound.			Central Standard. Lorain Branch	North Bound.		
15	13	11		12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria.....	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester.....	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester.....	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling.....	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover.	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport ...	.....	6:05	1:40
.....	8:25	.....	Bellaire.....	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

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No 35	Ind. & St. Louis Express.....	*12:00 m
No. 27	Columbus Accom.....	4:00 pm
No. 37,	Col , Cin. Express.....	*8:30 pm
		Arrive.
No. 28,	Cin. & Col. Express.....	*6. 45 am
No. 26,	Calion Accommodation.....	9:45 am
No. 36,	Indianapolis & St. L. Ex	*2:30 pm
No. 46,	Columbus & Cin. Express.....	*2:55 pm
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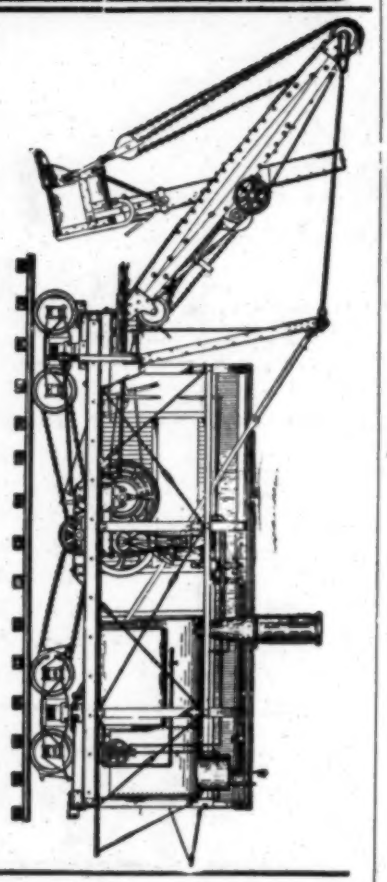

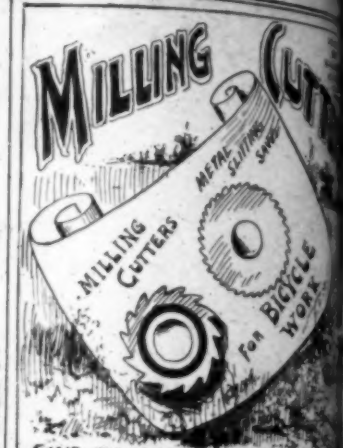

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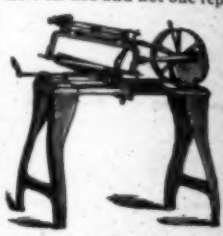

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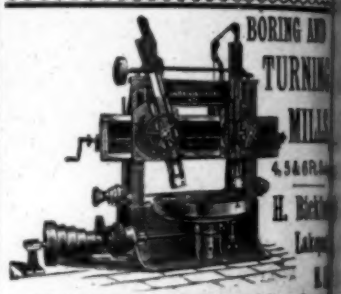

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